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RAILROAD GAZETTE

A JOURNAL OF TRANSPORTATION, ENGINEERING AND RAILROAD NEWS

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RAILROAD GAZETTE

FRIDAY, JANUARY 7, 1898.

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To Reverse or Not?

Law Office of Wilkinson & Cossum,
POUGHKEEPSIE, N. Y., Dec. 31, 1897.

TO THE EDITOR OF THE RAILROAD GAZETTE:

"M. E." will be interested perhaps to hear of a damage suit recently tried here, in which one of the questions at issue was as to the quickest and best method of stopping heavy, modern trains running at fast speed. A child had been run over and killed, and the plaintiff maintained that it was negligence for the engineer not to have reversed his engine.

Three of the best engineers that the New York Central could furnish were called as witnesses, and they each emphatically stated that they *would never under any circumstanees reverse their engines in order to bring the train to a stop.* When they had to stop a train in the shortest possible distance, they shut off the steam and applied the air, and did nothing else; there was only one quicker way to stop a train and that was to run into something. They agreed that upon reversing, the back pressure in the cylinders was so great as to lock the drivers and cause them to slide, thus loosing the breaking power of the locomotive. Neither did they approve of sanding the tracks, for nothing seemed to be gained by it, and there was a chance of its causing flat places to wear on the drivers.

Inasmuch as one of these men runs the Empire State Express, and both the others the Fast Mail (the first the fastest train, and the second about the heaviest, run by the New York Central), their testimony should be of interest, if not of value, in helping to determine what the best modern practice now is. M. H.

Heavy Rails and Smooth Track.

GREENSBORO, N. C., Jan. 3.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the articles in the *Railroad Gazette* of Dec. 3 and 24 in regard to heavy rails and smooth track, I concur with "Chief Engineer" to the extent that much of the heavy rails which have been laid within the past few years do not ride as smoothly as might have been expected; but I cannot agree in the opinion that the remedy must emanate wholly from the mechanical department in the way of better arrangement of springs and levers, although much can be accomplished in this manner. Neither is it my observation that this evil can be entirely corrected by our chief engineers and purchasing agents insisting that the rails be "properly straightened at the mills," as suggested by "General Manager," although it would not be wise to encourage poor work in this respect.

During the past three years I have had direct control of the laying and maintenance of several hundred miles of heavy rails, but I have not yet observed a case where the heavy rails, under the same conditions with respect to line and surface, did not give much better riding track than the light sections which they released. With light rails there is a continual undulatory motion, and any irregularities in surface and level are not so noticeable; while with heavy sections the converse is true, the cars are usually steady and any irregularities emphasize themselves by contrast, the more so because the heavy rails are stiffer. Where this rough riding has been observed the cause was not, as a rule, either bad springs or crooked rails, but unspaced ties or improper tamping. When these causes were removed the unpleasant effects disappeared also.

I have known heavy rails to run for a considerable time without the ties being spaced under them. The result of this is surface-bent rails of a more aggravating kind than those generally received from the mills, and they are often responsible for the rough riding mentioned. So far as possible all new rails should be laid in the spring in order that the whole summer may be had in which to space the ties and get them to an even bearing before heavy traffic and bad weather begin. It is useless to insist upon absolutely straight rails from the mills if an injury of this kind is permitted within a few months after the rails are laid.

To obtain hard and uniform tamping, in the proper manner and place, is one of the most difficult questions in practical track work, and no matter how favorable the conditions may be with respect to ballast, ties and rails the trackman who throw aside his level, lets his men tamp in a haphazard way and lets loose ties go unnoticed will have rough riding track, whereas the trackman who obtains a solid and uniform bearing without "pulling" or "raising" any more than is necessary to secure this (thereby effecting a considerable economy in ballast) will usually have smooth riding track with almost any section of heavy rails.

As I have already stated, I would not encourage inferior work at the mills; on the other hand, I think the inspection should be reasonably close, but it is rather inconsistent to lay undue stress upon slight variations in new rails where ties are allowed to swing.

J. A. DODSON.

The Gas Engine and its Mission.—1.

BY SIDNEY A. REEVE.*

The present importance and the future possibilities of the gas engine, a topic widely discussed in the engineering and manufacturing circles of the day, cannot be fully understood even in its most practical aspect without at least a glance at the past.

I.—CONSTRUCTION AND OPERATION.

Although the earlier periods of experiment are of interest to the student, the gas engine in the modern sense of the term could be conceived only after the advent of gas—an occurrence practically coincident with with the opening of the present century. By 1825 the world began to grasp the possibilities of illuminating gas; and one of those possibilities was the distribution of power by means of gas-pipes. From that time on, men of all grades of ability, from Ericsson with his "flame engine" down to a myriad of petty modifiers of existing designs, groped for some solution of the problem. However valuable was this period of groping, it brought nothing of commercial value until about 1861. While our Civil War was in progress the first regular market of successful engines was being established. In France, LENOIR was building and selling his double-acting engines, very similar to the ordinary horizontal steam-engines in external appearance; but his success was only temporary. One hundred cubic feet of gas per horse-power per hour, and with gas at four times its present cost, were too much for even a gas-engine, and hundreds were broken up for scrap. Scarcely was the Civil War over, however, before the next milestone of real progress looms up—the OTTO and LANGEN engine of 1866. By it the gas consumption mentioned above was cut into halves, while the mechanical operation, albeit hideously noisy, was such that Mr. ROOTS† records one engine, at least, still in operation to the satisfaction of its owner.

The next milestone of actual progress in gas-engineering coincided with one in our nation's growth—1876. In this year Dr. OTTO brought out the first of his "Silent" engines, working on the famous Beau de Rochas cycle. This engine was the prototype, in design and operation, of what has now come to be the accepted form of gas or oil engine throughout the civilized world. Infinitely as it has been modified by individual designers in matters of detail, probably 98 per cent. of the engines in use today operate upon this cycle. In fact, the great majority of them retain the horizontal, trunk-piston, single-acting arrangement of parts which is still exemplified in the Otto engine of to-day. The original factory at Deutz, across the river from Cologne, Germany, is still in active and progressive operation, and turns out a product which compares favorably with the early "boom" shown by the record of some 35,000 engines, aggregating 150,000 H. P., during the interval between 1876 and 1890.

To-day there are about 100 builders in the United States, of whom probably one-quarter own genuine works devoted exclusively to this business. The gas consumption has been brought down from about 40 cu. ft. in 1878 to the standard modern figures of about 20 to 25 cu. ft. for the smaller and cheaper designs, say 16 cu. ft., for the best of fair-sized engines under favorable conditions of actual operation, and 14 cu. ft., or slightly under, as a minimum record for fancy tests. Unfortunately, the varying fuel value of gas in different localities obscures the attempt at accurate comparison in this way.

The development of the oil engine followed the discovery of petroleum and the general distribution of its distillates, and has so closely followed the lines of gas-engine growth that many designs are interchangeably oil or gas engines at a moment's notice.

The Modern Engine.—In spite of the ferment of investigation constantly taking place, the different brands of gas engine on the market to-day differ from one another chiefly in the following points: *I., General arrangement; II., Method of governing; III., Method of ignition; IV., Type of valves; V., Color of paint.*

The importance of these points to the purchaser may be stated as follows; for these articles are not written from the standpoint of the designer, who must be a student so deeply versed that they will teach him little.

I. *General Arrangement.*—The choice between horizontal and vertical designs having been disposed of as easily settled on the score of convenience—for reliable articles are to be had in either type—the main distinction is between what may be styled the "Otto" and "Clerk" types, both operating upon the Beau de Rochas cycle.

The Otto type includes the vast majority of the designs of the day. To illustrate it we reproduce a cut of a modern engine from the Otto Works. The cylinder horizontal and single-acting, the piston a long plunger, the crank and fly-wheels double, the valve motion derived from a shaft revolving at half the speed of the crank shaft,—this description applies probably to seven-eighths of the gas engines in existence. Their method of operation, too, is uniform and proceeds as follows:

1st stroke (out): A mixture of gas and air is drawn into the cylinder;

2d stroke (back): This is trapped and compressed by the power stored in the fly-wheels;

3d stroke (out): After being ignited at the dead-center the compressed charge burns ("explodes") and expands doing work;

4th stroke (back): The burnt gases are exhausted.

The process is then repeated. Thus one stroke out of every four is a working stroke; the rest are idle. The fly wheels in this case must store up the power needed for compression, which is usually about 20 to 25 per cent. of the gross power developed, together with three-quarters of the remainder (or net power), for redistribution to the belt and to the compressing piston during the three idle strokes. This power absorbed by the fly-wheels amounts to about 80 per cent. of the total power developed in the working stroke.

The other type, the "Clerk," differs from this in that the engine has an extra or charging cylinder. While the main cylinder is making its working stroke the charging cylinder has drawn in the charge of gas and air and compressed it to a pressure slightly above atmospheric. When the main cylinder has completed its stroke its exhaust valve is opened simultaneously with, or slightly before, the opening of communication with the charging cylinder. The charge rushes in from the latter, driving before it the remnant of burnt gases out through the exhaust valve, which should be placed opposite the inrush. At the right moment both valves are closed and the main piston commences its back or compression stroke.

The advantages of this type are that it produces an impulse once each revolution, while the fly-wheels are called upon to store only 60 to 63 per cent. of the power developed. The disadvantages are, first, the difficulty in so timing the closing of valves before compression that neither any unburned gases escape through the exhaust valve nor do any burned gases remain to adulterate the charge being compressed; and second, the necessary addition of an idle cylinder. The first objection interferes so inevitably with the economy that even its designer, Mr. Dugald Clerk, has abandoned it for the Otto arrangement. It survives, however, in quite an array of smaller engines of a modified form in which the crank case of an Otto type engine is tightly enclosed, and, acting as the charging cylinder of the Clerk type by the pumping action of the trunk piston, permits an impulse to be had each revolution. The Sintz engine, which is a type of this class of engine, will be illustrated and described in a subsequent issue of the *Railroad Gazette.*

One other general arrangement, more distinct from the Beau de Rochas cycle than is the Clerk, must be mentioned. It is not blessed with a distinctive well-earned name. It consists of, first, the continuous compression in cylinders devoted exclusively to that purpose of supplies of gas and air to the maximum pressure within the engine; secondly, the combustion of these supplies under constant pressure, with volume increasing (as contrasted with the combustion of the de Rochas cycle, which is at constant volume with pressure increasing); thirdly, the continuous expansion of the products of combustion in cylinders devoted exclusively to that purpose.

According to whether this combustion occurs in the working cylinders, intermittently with each stroke, or continuously in a separate chamber constructed for that purpose, two sub-types are developed, known as "intermittent" or "continuous" combustion engines respectively.

While this general arrangement is merely mentioned here, its importance will be emphasized at a later point in these articles.

Before passing to minor points of difference in arrangement it were well to discuss more fully the effect of these major ones upon the efficiency.

The great jump of the early engine from an obscurity relieved only by the noise it made into such popularity as always follows improved efficiency, resulted directly from the adoption of *compression before ignition.* The bulk of its advance since that day of 40 ft. of gas per horse-power hour has also been due to the increase of preliminary compression to a higher and higher point. With Otto's early engines compression commonly reached 25 lbs. above atmospheric. To-day it more nearly averages 70 to 80 lbs.

With increased preliminary pressures came inevitably higher initial pressures, and following that all the long train of hot bearings and heavy fly-wheels consequent

*Adjunct Professor of Steam Engineering, Worcester Polytechnic Institute.

†James D. Roots, "The Cycles of Gas and Oil Engines," *The Engineer,* Sept. 17, 1897.

upon trying to control and absorb great pressures. Thus the ordinary initial pressure to-day is about 250 to 300 lbs. per square inch. The highest card I remember having seen showed compression to 96 lbs. and an initial pressure of 405 lbs. These are heavy pressures to handle, and as a consequence their rise has waited for the gradual improvement of manufacturing methods.

Speeds, too, have increased. These brought trouble from late ignition and from the completion of the stroke before combustion had been well out of the way. But refinement of design has done away with both troubles; and from the engine of 1882 compressing to 38 lbs., exploding to 130 lbs., rotating at 100 revolutions per minute, and consuming 24 ft. of gas per horse-power hour, we have advanced to the pressures given above and to a corresponding decrease in fuel consumption to about 14 ft. of gas. Speeds have risen to figures ranging from 180 revolutions per minute for 100-horse Otto engines to 300 revolutions for smaller stationary engines, and as high as 600 revolutions for special motors for vehicular or marine propulsion.

This whole question of route of advance is well stated in Mr. Clerk's last edition of "The Gas and Oil Engine."

A further diversity of arrangement is that between double and single action. As there is only one engine of the former class of any importance upon the market—that known as the "Griffin" or "Kilmarnock" in England, and the "American" in this country—it is hardly feasible to enter into too close a discussion of comparative advantages. It may be pointed out, however, that this arrangement gives with a single cylinder two impulses in one revolution, and none in the next revolution, or with two cylinders one impulse each stroke. In the former arrangement, however, while the work stored in the fly-wheels has to be only the 60 to 63 per cent. of the Clerk type, yet the period over which accumulation or distribution extends is twice as long as in the Clerk; hence the fly-wheel capacity for a given limit in speed variation must be twice as great as with the Clerk type, or equal to that of the Otto.

One of the most notable installations of these engines is at Belfast, in the city's electric-lighting station, a full report from which was presented to the British Institute of Mechanical Engineers at its meeting of 1896 and published in *Engineering* and *Engineer* for that year.*

Finally, the list would not be complete without mention of the latest arrival upon the field of large gas-engines—the Westinghouse. Although this engine operates upon the regulation Otto cycle, and has the same vertical single-acting, twin cylinders as the Westinghouse steam engines, yet it is novel in that its details represent a thorough working out of the problem by a firm of engineers of long experience according to accepted standards. In the smaller sizes it gets one impulse each revolution, but in the larger sizes, having three cylinders, it obtains an impulse, under full load, at each 240 deg. of crank rotation. It governs partly by modified and partly by missed explosions. It starts under full load from a reservoir of compressed air accumulated during the previous run. Its representatives are modestly reluctant to make official statements before more experience has been accumulated, but I understand that about 150 engines are now in operation or construction, that 250-horse engines are in existence, and that a fuel-rate of 13 ft. of natural gas per brake H. P. has been attained. To this engine and the "American" are due the credit of being the pioneers in assailing the problem of gas engines larger than 100 H. P.

II. *Methods of Governing.*—In general, these are two in number—governing by missed impulses, and governing by modified impulses.

The first consists of allowing the engine to work at its maximum power until the speed rises above normal, when the governor throws out the gas-admission mechanism and the engine runs without developing any power at all until the speed falls below normal, when the governor again turns on maximum power. This is simplicity (and crudity) itself. As the governor has an opportunity of controlling the engine only once every two revolutions, and has the interim of from one-half to one second in which to adjust itself to any new condition of load or speed, any moderately prompt design of governor will be fully up to the level of its opportunities. This simple fact confines the problem of regulation in this type of engine to modifying, as far as possible by means of heavy fly-wheels, the variation in speed inevitable between one impulse and the next. The bulk of the improvement in gas-engine regulation during recent years is due solely to increase of speed.

The second consists, almost universally, of having the governor vary from stroke to stroke the amount of gas admitted for combustion in combination with the fixed quantity of air taken in for each charge. This fits the impulse to the load at each instant and usually leads to a finer degree of regulation than the other. The big objection to it, however, is the diminished economy due to the fact that the mixture of gas and air is always more or less distant from the true proportion for maximum economy. Thus at Belfast, a station so large and thoroughly equipped that its results may be taken as the best attainable in commercial practice, the best figure obtained under this method of governing was 19 cu. ft. of Glasgow (an exceptionally rich) gas per indicated horse-power hour, while a fair average was 24 ft. of Belfast gas. From this point the figures ranged upward, as the load fell off, until 40 ft. was the average for one-quarter load. The latest type of "American" engine appears to have abandoned this method in favor of missed explosions.

Some engines combine these two methods, governing by modified impulses down to a certain point in the decrease of load and then regulating for still lighter loads by missed impulses. This is a compromise between two evils and is no better than either.

A method widely used on the continent, as in the Charon engines, and deserving of trial in this country, is to have the governor hold open the admission valves during a greater or less portion of the compressing stroke. This drives a portion of the maximum charge back into the supply pipes ready for use in the next impulse while the remainder is compressed and utilized. The objection to this is that the modified charge does not undergo as high compression as does the full charge; the advantage is that it attains a greater degree of expansion than does the latter, the result being a much more constant economy under variable load, coupled with quite good regulation.

The same result is sometimes obtained by closing both admission valves before the suction stroke is complete, for a partial impulse. The piston then sucks a partial vacuum and re-compresses to atmospheric pressure at the point where admission closed on the suction stroke.

A fair comparison of gas engine regulation with that of steam engines may be had by comparison of the following diagrams (Fig. 1), in which the horizontal divisions represent each a revolution while the height of the wavy line represents comparatively the variations in engine speed from instant to instant; the straight lines represent normal speed. The governor is in each case assumed to be perfect.

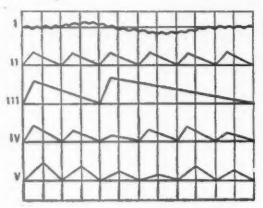


Fig. 1.

Diagram I. represents a steam engine. The speed is seen to vary twice during each revolution, as the crank is either working or passing dead centers. In high speed or multiple-cylinder engines this fluctuation is inappreciable. Aside from this there is a general rise and fall of speed with the load.

Diagram II. represents a single-cylinder Otto-type gas engine working at maximum load. During each fourth, or working stroke, the speed rises sufficiently so that the three succeeding, or idle strokes, reduce the speed to merely normal. If the load be half of normal, as in the first part of diagram III., the fly-wheels have to absorb at least 90 per cent. of the impulse and the speed varies still more widely; if quarter-load, as shown in the second portion, the fly-wheels must absorb at least 95 per cent. of the impulse, and the fluctuation in speed is greater yet.

Diagram IV. represents the fluctuation of a single-cylinder gas engine governing by modified charges. Diagram V. represents the same type of engine built double-acting.

It is obvious from the diagrams that it is childish to argue comparative regulation from the basis of revolution-counterreadings, which can take no cognizance of these differences. Any one of these diagrams may average up to within two per cent. of normal revolutions per minute under wide fluctuation of load, and yet the regulation may be villainously poor in between times.

Ignition.—In this department of gas-engine operation, outside of the freaks, there are but two methods of procedure now in use—that by "hot tube" and that by electric spark. The former consists of a hollow cylindrical or tubular protuberance from the clearance space of the cylinder, surrounded by a Bunsen flame and thereby heated to redness. Most commonly the compression of the fresh charge is relied upon to squeeze itself into this protruding tube, against the resistance of the burnt gases still lying there, until it reaches the incandescent portion, at the time of maximum compression, when it ignites. In the larger and more elaborate engines, and especially those designed abroad, a "timing valve" is interposed between the fresh charge and the hot tube. This valve is opened by the engine mechanism at the proper instant, thus guarding against too early ignition.

The electric spark method consists of the familiar battery and induction coil, the circuit being sharply broken within the cylinder at the proper moment by the engine mechanism.

The comparatively even distribution of these two methods between various designs precludes any decided stand in favor of either. In general it may be said that Europe seems to be gravitating toward the hot-tube method, while this country seems equally in favor of the electric spark. From this it might be judged that the balance of economy stood in favor of the hot tube, while the argument of convenience stood in favor of the electric spark.

Types of Valves.—The old-fashioned slide-valve, which came in with the early Otto "Silent" engine, is practically obsolete, only one design in this country still retaining it, to my knowledge. What has displaced it so universally is the "mushroom" or flat, poppet, disk valve, usually held open or shut, as the case might be, by a spring, the opposite motion being given it by a cam-and-lever mechanism operated from a gear driven at half speed by the main shaft. The variations in this mechanism are so numerous as to defy description or even classification here.

These two general remarks may be made, however: That experience seems to prove that a hyperboloida gear for getting the half speed from the main shaft runs more quietly and wears better than either a spur or a bevel gearing; the former are used almost exclusively in England. Secondly, another tendency markedly visible in this country, in contradistinction to either England or the continent, is to eliminate as far as possible the positive movement of valves by means of the valve motion and to substitute therefor the automatic action of the valves under the impulse of the working gases. As a consequence, American engines are much simpler in appearance, as well as lighter in weight, than the European designs.

This tendency is carried to its extreme in the type of Clerk engines which I have illustrated by the Sintz engine. Some of these engines, in one design with as many as three cylinders, have no valve motion at all; their moving parts consist merely of pistons, connecting rods, shaft, wheels and these automatic valves. They will naturally run equally well in either direction, according to whichever way they are started by hand.

The Color of Paint.—It was not without serious purpose that this feature was included in the list as worthy of discussion, even in an article so limited in space as this. One of the greatest thieves of a business-man's time is the difficulty of choice among a long series of designs, each of which claims especial worth. To the experienced buyer it is no news that the differences are exaggerated and "consist," as one such aptly expressed it, "largely in the color of their paint." To the non-technical buyer it may be worth while saying, however, that there is no mysterious connection between some little specialty of valve motion and efficiency. Having chosen his type of engine according to the points listed above as important, it is hard to make a mistake. If reliability is wanted let him chose from the older or more responsible houses. If price is important, the solution is easy. If efficiency is important let him go only by actual tests, under actual conditions of variable load. But if an engine representative come at him with the statement that his engine is "more economical than any other," let him be met with the question as to the color of his paint; for the latter means vastly more to the purchaser's ledger than does this infantile boast of "economy better than that of any other make."

[TO BE CONTINUED.]

* A detailed description of the "American" engine will be published in a few weeks.

The New East River Bridge.

On Dec. 29 Mr. L. L. Buck, Chief Engineer of the New East River Bridge, made his annual report to the Commissioners. Of course, it is brief; the main points follow:

At the beginning of the year the only contract for actual construction that had been let was that for the New York tower foundations, with Patrick H. Flynn, executed Oct. 23, 1896, by which the contractor agreed to do the work for about $370,000. Prior to Jan. 1, 1897, no work had been done under this contract other than to receive materials, fairly start the construction of the north caisson and open a quarry for limestone at Saugerties. On Sept. 17 bedrock was first struck at an elevation of 43.5 ft. The cutting edge had been sunk to an elevation of 38.2. By Dec. 1 a good foundation had been reached and it was decided to stop the sinking when the cutting edge had reached an elevation of 54.81 ft. This foundation consists of bedrock, of the ordinary New York gneiss formation, under the whole area of the caisson. The pier is now finished to an elevation of 2.54 ft. above mean high water.

Work on the south New York caisson was started at the contractor's yard immediately after the launch of the north caisson, and it was launched Sept. 30 and towed to the tower site. Concreting began Oct. 19 and the concreting on top is not yet completed.

The contract far constructing the New York anchorage was awarded to Shanly & Ryan and was executed Oct. 5. The contract price is $716,770, plus the cost of the piles used. Work under this contract was begun Oct 9. Thus far work has been preliminary in character. The work is now in such shape that excavation may be begun the first week of the new year.

The contract for constructing the Brooklyn tower foundations was awarded to Colin McLean and bears date June 30, 1897. The contract price is about $507,000. The first timber was received and construction was begun July 26. The south caisson was launched Oct. 19 and the north caisson Dec. 15. Concreting the south caisson was begun Nov. 24. About 1,700 cu. yds. of concrete have been placed. The cofferdam for the south caisson was begun Dec. 6, and has been carried to a height of about 15 ft. In the meantime the timber work of the north caisson has reached a height of about 26 ft.

The contract for the Brooklyn anchorage was awarded to the Degnon-McLean Construction Company and was executed Oct. 1. The contract price is $721,850, plus the cost of the piles used. The contractor began to tear down the buildings on the site Oct. 27, and this work is still in progress.

The plans and specifications for the towers and the end spans are nearly finished. It is expected that they will be completed so that the contracts for construction and erection can be advertised Jan. 19, 1898.

The cost of the work under contract will be approximately as follows:

New York tower foundations	$370,000
New York anchorage	716,770
Brooklyn tower foundations	507,000
Brooklyn anchorage	721,850
Total	$2,315,620

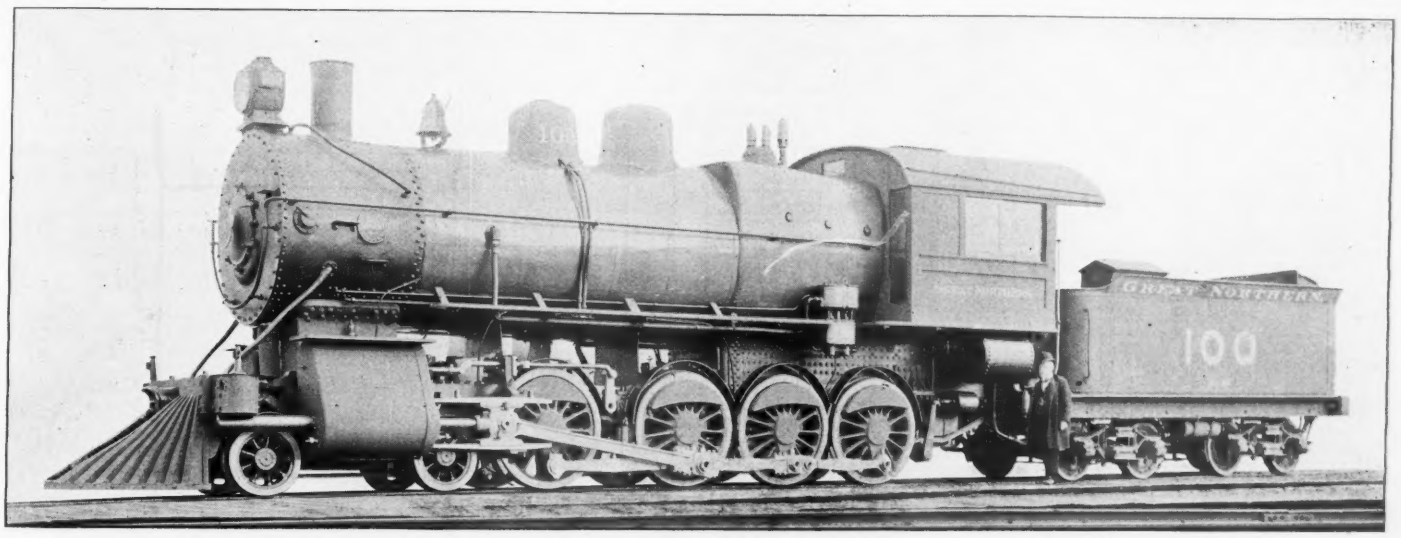
Heavy 12-Wheel Locomotives for the Great Northern.

In our issue of October 29 last we illustrated quite fully a special mountain locomotive for the Mexican Central, which, in the matter of total weight of engine, was second only to the heaviest locomotive of which we have record. In the present issue is described one of two mastodon locomotives delivered during December to the Great Northern Railroad by the Brooks Locomotive Works for use on the Montana divisions of that road. It is claimed by the builders that these engines are of greater weight and size than any so far built, and our records show none larger.

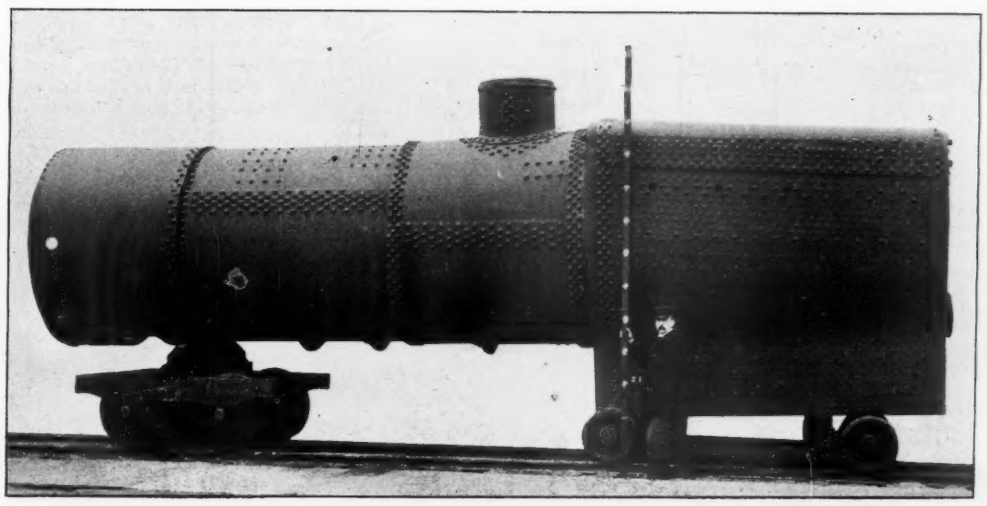
The general appearance of one of these engines is shown by the engraving, from a photograph, the principal features of the construction, the boiler and its most important details and the arrangement of the cylinders and steam chests are all well shown by photographs and line drawings.

The engine is designed for simple working and to burn bituminous coal. The total weight in working order is 212,750 lbs., 172,000 being the weight on the driving wheels. The distribution of the weight on the different wheels is as follows: On each pair of truck wheels, 20,375 lbs.; on the first pair of drivers, 42,000 lbs.; second pair of drivers, 45,000 lbs.; third pair of drivers, 43,000 lbs.; fourth pair of drivers, 42,000 lbs. The total weight of the engine and tender is 308,750 lbs. The driving wheel base is 15 ft. 10 in., and the total wheel base is 26 ft. 8 in.

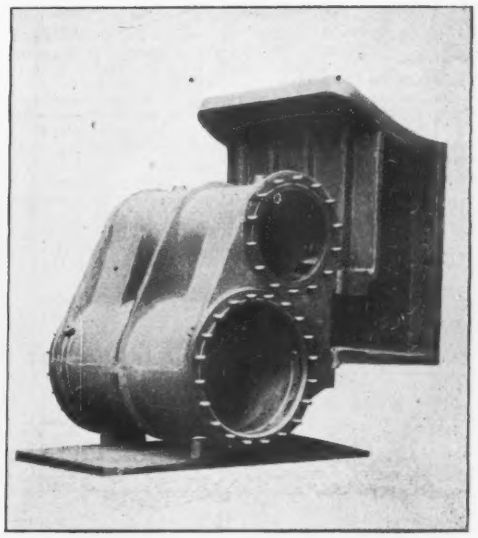
The cylinders are 21 in. in diameter × 34 in. stroke, and the driving wheels are 55 in. in diameter. This is probably the largest stroke so far used on a locomotive and is necessary to get sufficient expansion in the cylinders, as the working steam pressure is 210 lbs. per square inch, being higher by about 30 lbs. per square inch than the pressures commonly used with single expansion locomotives.



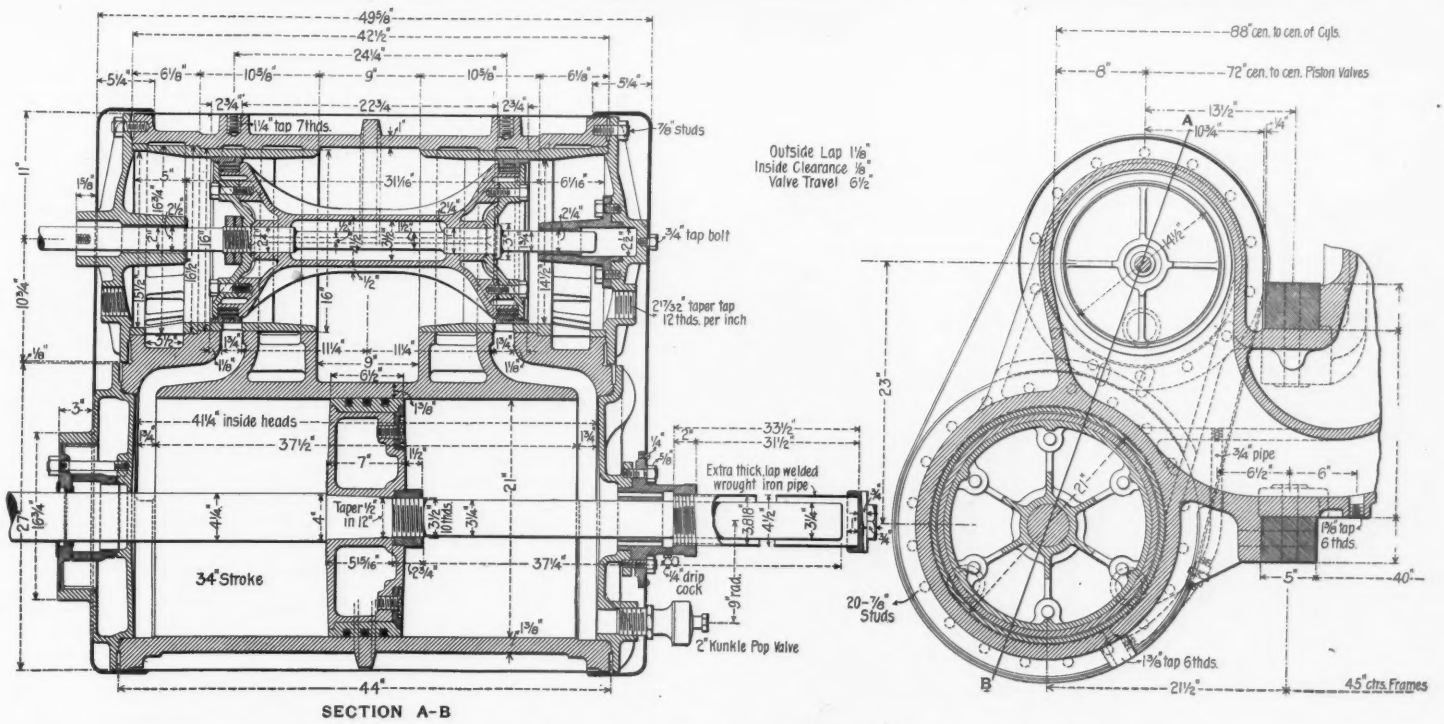
Twelve-Wheel Locomotive for the Great Northern Railway.



Boiler of Brooks 12-Wheeler for the Great Northern.



Cylinder and Saddle Casting.

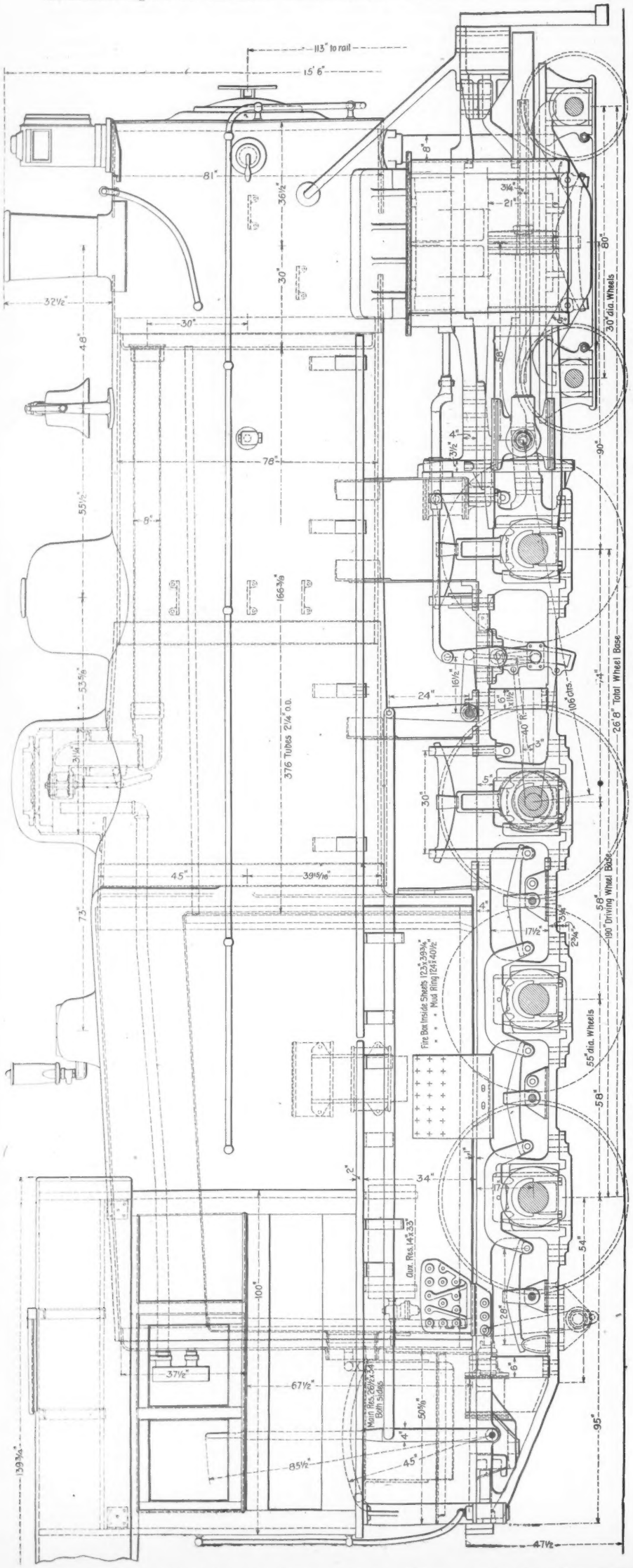


Cylinder and Steam Chest—Great Northern 12-Wheeler.

The boiler is of steel of the Player-Belpaire type, the largest diameter being 87⅛ in., while the diameter of the smallest ring is 78 in. The firebox is also of steel, is above the frames and is 10 ft. 4 in. long, 8 ft. 4½ in. wide, and varies from a depth of 86⅝ in. at the front to 79 in. at the back. There are 376 tubes, 2¼ in. outside diameter and 13 ft. 10⅝ in. long. The boiler, dome, cylinders, steam chests and cylinder saddles are covered with asbestos. Piston valves are used to insure a perfect balance under the high steam pressure, and the piston rods are extended through the front cylinder heads.

The heating surface of the firebox is 285 sq. ft., that of the tubes 3,045 sq. ft., making a total heating surface of 3,280 sq. ft.; the area of the grate is 34 sq. ft.

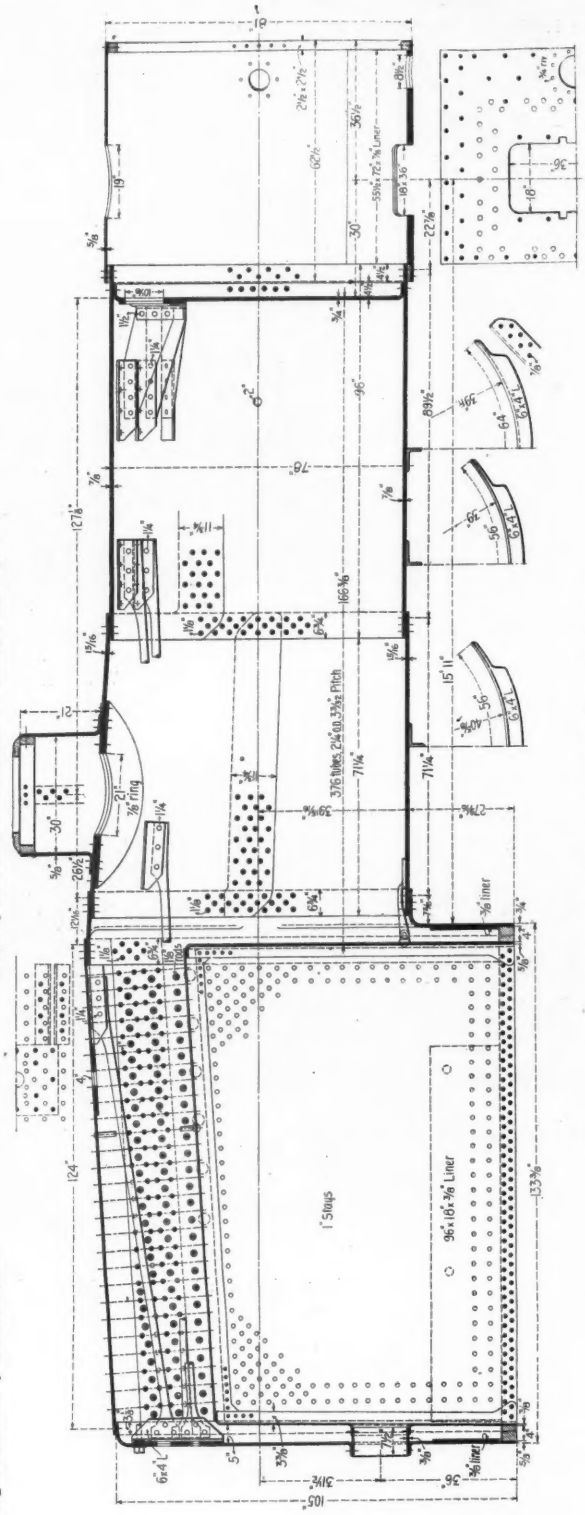
The tender is unusually large, having a capacity for 4,670 gals. of water and 10 tons of bituminous coal.



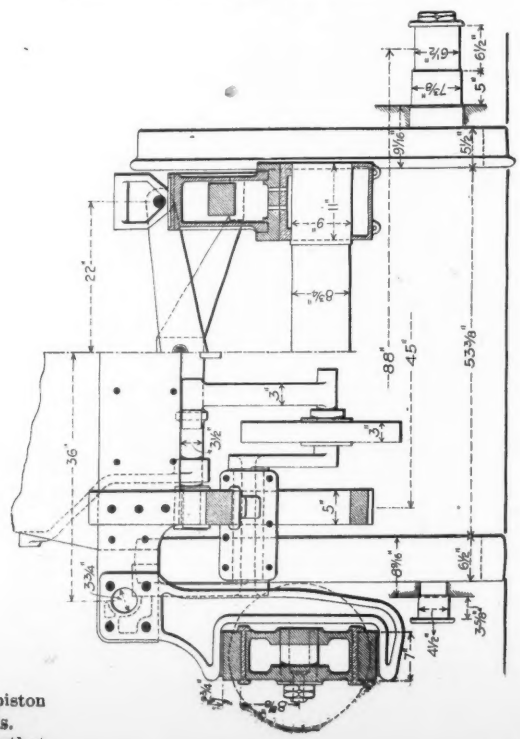
Twelve-Wheel Freight Locomotive for the Great Northern Railway.—Cylinders 21 in. × 34 in.—Total Weight, 212,750 lbs.—Weight on Drivers, 172,000 lbs.

Built by the BROOKS LOCOMOTIVE WORKS, *Dunkirk, N. Y.*

Mr. J. O. PATTEE, *Superintendent of Motive Power.*



Details of Boiler—Great Northern 12-Wheeler.



Frame Sections—Great Northern 12-Wheeler.

The driving wheel centers, engine truck wheel centers, driving boxes, driving box saddles, spring fulcrums, pistons, front and back cylinder heads, crossheads and guide yoke ends are of cast steel. The cylinder head casings, smokebox front and door, smokestack base, dome casing and sandbox casing are of pressed steel. The steam pipes are of malleable iron.

BROOKS TWELVE-WHEEL FREIGHT ENGINE FOR THE GREAT NORTHERN RAILWAY.

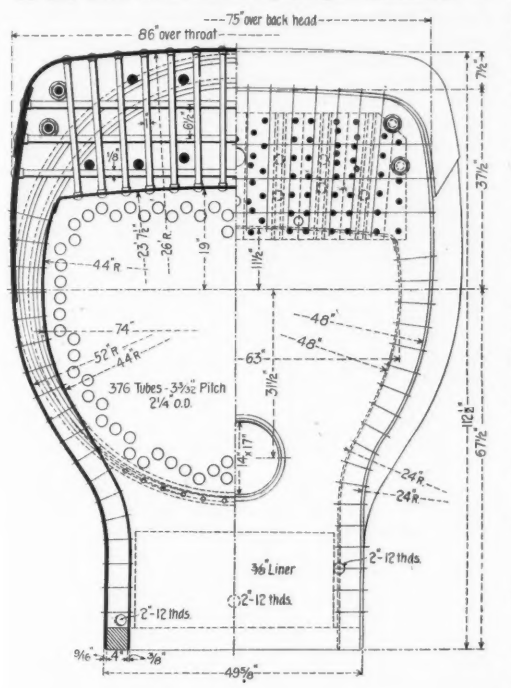
Weight of tender loaded	308,750 lbs.
Wheel base, total (engine and tender)	54 ft. 3¼ in.
Length, total, engine and tender	64 ft. 1½ in.
Height, center of boiler above rails	9 ft. 5 in.
" of stack above rails	15 ft. 6 in.
Wheels and Journals.	
Drivers, number	8
Drivers, centers	Cast steel
Truck wheel centers, diameter	30 in.
Journals, driving axle, size	9 in. × 11 in.
" truck " "	5½ in. × 12 in.
Main crank pin, size, main rod, 6½ in. × 6½ in.; connecting rod, 7⅝ in. × 5 in.	
Cylinders.	
Cylinders, diameter	21 in.
Piston, stroke	34 in.
" rod, diameter	4¼ in.
Kind of piston rod packing	Metallic
Main rod, length center to center	8 ft. 10 in.
Steam ports, length	18 in.
" " width	1¾ in.
Exhaust ports, length	30 in.
" " width	9 in.
Bridge, width	6¾ in.
Valves.	
Valves, kind of	Piston
" greatest travel	6½ in.
" outside lap	1⅛ in.
" clearance	⅛ in.
" lead in full gear	0 in.
Boiler.	
Boiler, type of	Player Patent Belpaire
" working steam pressure	210 lbs.
" material in barrel	Steel
" thickness of material in barrel	⅞ and 1⅛ in
Seams, kind of, horizontal	Sextuple lap
" " circumferential	Triple lap
Thickness of tube sheets	¾ in.
Crown sheet stayed with	Direct stays
Dome, diameter	30 in.
Firebox.	
Firebox	Horizontal over frames
" material	Steel
" thickness of sheets	⅝ in.
" brick arch?	No
" water space, width	Front, 4 in.; sides, 7 in.; back, 5 in.
Grate, kind of	Cast iron rocking
Smokebox.	
Smokebox, diameter	81 in.
" length	67 in.
"	Snowden Bell's short front end design
Other Parts.	
Exhaust nozzle	Single
" "	Permanent
" " diameter	5⅛, 5⅝ and 5¾ in.
" " distance of tip below center of boiler	6 in.
Netting	Improved Bell spark arrester
" size of mesh or perforation	2½ in. × 1¼ in. and 2½ in. × 2½ in.
Stack	Taper
" least diameter	15⅜ in.
" greatest diameter	18 in.
" height above smokebox	2 ft. 8½ in.
Tender.	
Type	4-wheel swivel
Tank capacity for water	4,670 gals.
Coal capacity	10 tons
Kind of material in tank	Steel
Thickness of tank sheets	⅜ and ¼ in.
Type of under-frame, wood or iron	10-in. steel channel
Truck with swinging motion or rigid bolster	Rigid
Type of truck spring	Semi-elliptical
Diameter of truck wheels	33 in.
" and length of axle journals	4¼ × 8 in.
Distance between centers of journals	6 ft. 3 in.
Diameter of wheel fit on axle	5¾ in.
Diameter of center of axle	4¾ in.
Type of truck bolster	Rigid.
Length of tender frame over bumpers	21 ft. 10½ in.
" " tank	19 ft. 6 in.
Width of tank	8 ft. 8 in.
Height of tank, not including collar	55 in.
Height of tank over collar	67 in.
Type of back drawhead	Plain
With or without water scoop	Without
Names of Makers of Special Equipment.	
Wheel centers	Pratt & Letchworth Co.
Tires	Krupp
Axles	Pennsylvania Steel Co.
Tender truck wheels	Krupp
Sight-feed lubricators	Nathan Mfg. Co.
Safety valve	Crosby Steam Gage & Valve Co.
Sanding devices	H. L. Leach
Injector	Nathan Mfg. Co.
Driver brake equipment	New York Air-Brake Co.
Tender brake equipment	" " "
" " beam	Monarch Brakebeam Co.
Air pump	New York Air-Brake Co.
" " governor	" " "
Steam gages	Crosby Steam Gage & Valve Co.
Engine truck springs	A. French Spring Co.
Driving springs	" " "
Tender springs	" " "
Piston rod packings	C. C. Jerome
Valve "	" " "
Headlight	Glazier Headlight Co.
Whistle	Curran

TABLE OF DIMENSIONS OF HEAVY LOCOMOTIVES COMPARED WITH THE GREAT NORTHERN 12-WHEELER.

	Twelve-wheel locomotive, Great Northern.	Special Mountain engine, Mexican Central.	Twelve-wheel locomotive, Northern Pacific.	Decapod tank locomotive, St. Clair Tunnel, Grand Trunk, of Canada.	Decapod, Burlington & Missouri River.	Decapod, New York, Lake Erie & Western.
Name of builder	Brooks.	Brooks.	Schenectady.	Baldwin.	Rogers.	Baldwin.
Fuel	Bituminous coal.	Bituminous coal or wood.	Bituminous coal.	Anthracite.	Bituminous.	Anthracite.
Weight on drivers, lbs.	172,000	145,200	150,000	180,000	150,200	172,000
" " trucks	40,750	F. 23,450 B. 24,800	36,000			23,000
" total	212,750	193,450	186,000	180,000	150,300	195,000
Wheel base, total, of engine	26 ft. 8 in.	28 ft. 2 in.	26 ft. 4 in.	18 ft. 5 in.	17 ft. 10 in.	27 ft. 3 in.
" " driving	15 ft. 10 in.	13 ft. 0 in.	15 ft. 6 in.	18 ft. 5 in.	17 ft. 10 in.	19 ft. 10 in.
Length over all, engine	41 ft. 4 in.	36 ft. 6¾ in.		39 ft. 10½ in.	35 ft. 8 in.	
Heating surface, firebox	235 sq. ft.	218.0 sq. ft.	206.5 sq. ft.	193.0 sq ft.	180.0 sq. ft.	234.3 sq. ft.
" " tubes	3,045 sq. ft.	2,585.0 sq. ft.	2,721.6 sq. ft. Water tubes 15.3	2,218.8 sq. ft.	2,172.0 sq. ft.	2,208.8 sq. ft.
" " total	3,280 sq. ft.	2,803 sq. ft.	2,943.4 sq. ft.	2,411.8 sq. ft.	2,352.0 sq. ft.	2,443.1 sq. ft.
Grate area	34 sq. ft.	31.45 sq. ft.	35.0 sq. ft.	38.6 sq. ft.	37.5 sq. ft.	89.5 sq. ft.
Drivers, diam.	55 in.	49 in.	55 in.	50 in.	50 in.	50 in.
Cylinders, diam.	21 in.	21 in.	23 and 34 in.	22 in.	22 in.	16 and 27 in.
" stroke	34 in.	26 in.	30 in.	28 in.	28 in.	28 in.
Boiler, type	Belpaire	Belpaire wagon top	Extended wagon top	Straight	Belpaire	Straight
Working steam pressure, lbs. per sq. in.	210	180	200	160	160	180
Boiler, outside diam. barrel	78 in.	78 in.	72 in.	74 in.	68 in.	76 in.
Firebox, length	10 ft. 4 in.	10 ft. 1 in.	10 ft. ⅞ in.	11 ft. 7/16 in.	11 ft. 6 in.	10 ft. 11⅝ in.
" width	3 ft. 4⅛ in.	3 ft. 2⅛ in.	3 ft. 6 in.	3 ft. 6½ in.	3 ft. 5 in.	8 ft. 2⅛ in.
" depth front	86½ in.	82 in.	77 in.	64¼ in.	61½ in.	
" " back	79 in.	75 in.	73½ in.	61 in.	59 in.	
Tubes, number	376	412	332	281	229	354
" outside diam.	2¼ in.	2 in.	2¼ in.	2¼ in.	2½ in.	2 in.

The piston rods, crank pins and crosshead pins are of high-grade open-hearth steel, the piston rods and crosshead pins being hollow. The rockers are of hammered iron and hollow; the side and connecting rods are also of hammered iron. The Player design of reverse lever is used.

In the table herewith the principle dimensions of



Details of Boiler.

some heavy locomotives are compared with those of the new Great Northern engines.

The most satisfactory comparison is that which can be made between the new engines and the 12-wheel compound locomotives of the Northern Pacific, because the type is the same in both cases. The new Great Northern engines, it will be seen, have a considerably greater weight than the Northern Pacific locomotives, a greater heating surface, a larger boiler and firebox, but a slightly smaller grate, the grate area of the Northern Pacific engines being 35 sq. ft. against 34 sq. ft. for the Great Northern Locomotives. The drivers in each case are of the same diameter.

The following is a list of the general dimensions of the Great Northern engines not included in the comparative table.

Thermodynamics Without the Calculus.*—I.

BY GEORGE RICHMOND.

In giving a brief outline of the method of treating heat relations, which, on account of its extreme simplicity, is coming more and more into general use, it must not be supposed that there is any disposition to undervalue the importance of the higher branches of mathematics. The contention is simply that the use of the calculus is no more essential to an intelligent use and understanding of such thermodynamic problems as ordinarily concern the engineer than it is necessary in order to find the horsepower of an engine from the indicator diagram. This diagram, in fact, affords a most striking illustration of the advantage of graphical representation, not only in fixing our ideas, but also in facilitating calculations. A mere inspection of it conveys an amount of information which, if clothed in mathematical formulas, would be unavailable to many, and perfectly intelligible to few, if any. Conversely, we may expect that when the heat relations we are accustomed to see expressed in formulas are presented in graphical form, they will be very much more intelligible. Results are thus rendered available to the non-mathematical reader, and an almost equal benefit accrues to the mathematician. . . .

It will be a surprise to many to learn that Zeuner uses the temperature entropy diagram throughout in his masterly treatise.† The most complete treatment of the subject hitherto published is to be found in the treatise of J. Boulvin.‡ In this case the results are obtained directly from the heat diagram, and very useful auxiliary diagrams are introduced, which have been recently reproduced with modifications by Professor Reeves §

In the English language we find a brief account by Professor Cotterill, as already mentioned, and a much fuller treatment by Professor Ewing.‖ This latter treatise may be unreservedly commended to all who wish to study the subject on these lines.

The temperature entropy, unlike the indicator diagram, cannot be traced automatically, but it can be so easily constructed that we can conceive the tracing points linked together by such a mechanism that, while the ordinate of the $p\ v$ diagram is sweeping out areas representing work done by or on the substance, the temperature ordinate is concurrently sweeping out areas representing heat applied or heat removed.

In a closed cycle the pencil on each diagram will return to its starting point at the same time, and the two together will give a complete history of the transaction; the one will have traced a closed area representing either the net work obtained, or the net work done, while the closed area traced by the other pencil represents the net amount of heat missing from the system, or the net amount by which it is increased. The two areas are equivalent; the one representing in foot pounds, and the other in heat units, the heat that has been converted into work, or conversely.

The fact that these two areas are equivalent is an expression of the first law of thermodynamics, and for this purpose any co-ordinates fulfilling this condition would have answered. The choice of the absolute temperature as one of the co-ordinates is an expression of the second law. Take for example the familiar Carnot cycle bounded by two isothermals and two adiabatics.

The temperature entropy finger of our supposed instrument would trace out a rectangle (Fig. 1), which is

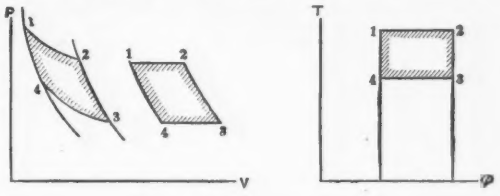


Fig. 1.—The Carnot Cycle.

a complete heat record. Comparing point by point the two diagrams—

1 to 2, addition of heat at constant temperature: *isothermal expansion.*

2 to 3, reduction of temperature without addition or removal of heat: *adiabatic expansion.*

3 to 4, removal of heat at constant temperature: *isothermal compression.*

4 to 1, increase of temperature without addition or removal of heat: *adiabatic compression.*

The quantity of heat added in passing from 1 to 2 is represented by a rectangle, whose height is the absolute temperature. The width of this rectangle is therefore the quotient of two known quantities. If, for example, the passage from 1 to 2 represents the evaporation of 1 lb. of water at 80 lbs. pressure, corresponding to an absolute temperature of 773 deg. and a latent heat of 896 thermal units, the width, or entropy, is 896 ÷ 773 = 1.157. If, on the other hand, a perfect gas is expanded at the same temperature isothermally from 1 to 2, we know that in this case the work done, as shown on the indicator diagram, is exactly equivalent to the heat supplied, as shown on the heat diagram. We also know that if r is the ratio of expansion, this work area is equal to $R\ T \log_e r$. This divided by 778, to convert it from foot pounds to thermal units, is the area of the rectangle, and its width must be obtained by dividing by T; that is, the width, or entropy, in this case, is $R \log_e r$. . . .

A few examples only are necessary. In the first place, most of the propositions relating to entropy, which seem rather elusive when referred to the $p\ v$ co ordinates, are little more than truisms when referred to the $T\ \varphi$ co-ordinates. For example: (1) The entropy imparted in passing from one adiabatic to another is the same by whatever path the passage takes place. This is equivalent to the statement that the distance between two parallel lines is everywhere the same. (2) The heat absorbed or given out by a substance in passing from one state to another is given by the area between the curve

* Condensed from a paper presented at the New York meeting of the American Society of Mechanical Engineers.

† *Technische Thermodynamik*, von Dr. Gustav Zeuner. Erster Band, 1887; Zweiter Band, 1890.

‡ *Cours de Mecanique applequee anu machines 3me fascimile theories des machine thermiques.* J. Boulvin, Paris, 803

§ *The Entropy-Temperature Analysis of Steam-Engine Efficiencies.* Sydney A. Reeve, 1897.

‖ *The Steam Engine and Other Heat Engines.* By J. A. Ewing, Cambridge, 1894.

representing the change of state and two adiabatics, one drawn through each extremity of this curve (Fig. 2). (3) If a series of equidistant isothermals be drawn between two adiabatics, they will cut off equal areas from

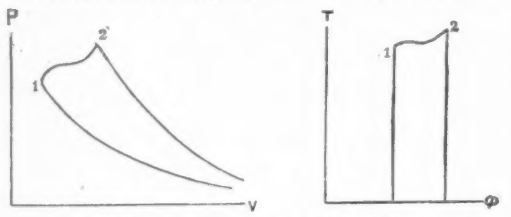


Fig. 2.—Heat Absorbed in Passing from State 1 to 2.

the diagram. (4) When heat passes from one body to another the entropy of the system is increased. For since heat passes only from a warmer to a colder body, the width of the resulting lower temperature heat area must be greater than the width of the equal, but higher temperature, heat area. . . . . (5) The equations of adiabatics can be written down at sight from the $T\varphi$ diagram, if we know enough to express the criterion of parallelism.

It will now be shown how easy it is to transfer points from one diagram to the other, choosing first of all the indicator diagram of the steam engine, making, however, the expansion curve that of satuated steam (Fig. 3), and assuming that there js no clearance.

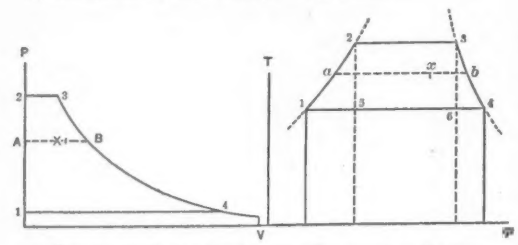


Fig. 3.—Indicator Card on the Temperature-Entropy Diagram.

The diagram on the $p\,v$ ordinates requires no explanation; it is obtained by merely plotting the concurrent values of the specific volume and pressure as found in the tables. It is now usual to find in text-books the tables necessary to construct the diagram on the $T\varphi$ ordinates.

The length 1 4 is the entropy of one pound of steam at the temperature T_1 and the length 2 3 that at the temperature T_2. We may proceed as follows:

Draw the isothermal line 1 4 of length as given by the table of entropy, and at a distance from the base equal to T_1, on the scale chosen, and complete the rectangle. The height of the line 2 3 is known, being T_2, and the position of the point 2 may be found from the table, as follows: The area swept out by a vertical line following the curve from 1 to 2 represents the heat required to heat the water from 1 to 2 prior to its ovaporation at 2. The horizontal travel of this line is tabulated under the head of entropy of the liquid, usually written, r. The difference between its value at T_2 and T_1 is the length 1 5, through which we draw the vertical 5 2 which determines 2; join 3 and 4, and the diagram is complete. If, instead of connecting 1 2 and 3 4 with straight lines, we wish to complete once for all the correct curves, it is only necessary to take a series of temperature intervals very close together, proceed as before, and then join the points thus found with a continuous curve. These two area bound our knowledge of the physical properties of the substance as given in the tables, and any point inside one area can be transferred to the other by observing that *corresponding points in each diagram divide the horizontal lines through them in the same proportion.*

A few easy exercises may be suggested. Boiler pressure being 80 lbs. and exhaust into the atmosphere, then, excluding action of the cylinder walls:

(1) If steam is dry at the cut off, how much moisture will it contain at the end of the expansion?

(2) If steam contains 15 per cent. moisture at beginning of expansion, how much will it have at 10 lbs. pressure?

(3) If all water is turned into the cylinder, how much of it will be steam at 40 lbs. pressure, at half stroke, at temperature of 240 deg.?

(4) Draw an adiabatic on the $p\,v$ diagram, corresponding to initially dry steam, and to steam containing 10 per cent. moisture.

(5) If the steam is assumed to have initially 15 per cent. moisture, and to expand along the hyperbolic curve, draw this, transfer it to the $T\,\varphi$ diagram, and find how much heat the steam received or rejected during expansion.

(6) Assume in previous case that the steam is exhausted at 10 lbs. pressure.

Perfect Gases.—For perfect gases we have a much larger area of explored territory, and for every point where the characteristic equation

$$P\,V = R\,T$$

holds true we can pass from one diagram to the other with the greatest facility. R being a constant, we obtain at once the value of T corresponding to any pair of concurrent values of P V by simple construction (Fig. 4.) We also know the rates at which heat is added when the pressure and also when the volume

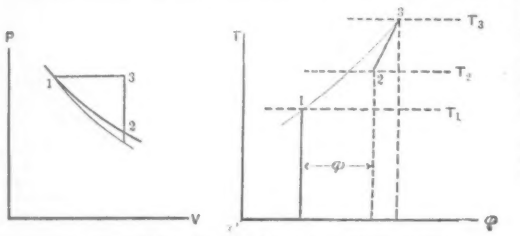


Fig. 4.—Transfer of Points for Perfect Gases.

remains constant. These are the specific heats, which we will name m and n. We have seen that when heat is added at a fixed rate of m or n units per degree rise of temperature, the curve traced by the extremity of the traveling temperature ordinate is the logarithmic curve, and the entropy in passing from T_1 to T_2 is $m \log_e \frac{T_2}{T_1}$ and $n \log_e \frac{T_2}{T_1}$, respectively.

These being fixed curves, they may be cut out once for all and marked *constant pressure curve*, and *constant volume curve*, respectively. All usual thermodynamic problems relating to perfect gases may then be solved on the drawing board. Suppose, for example, we wish to transfer the points 1 and 2 from the $p\,v$ co-ordinates to the $T\varphi$ co-ordinates, and thereby determine the heat imparted or removed in passing from 1 to 2:

Draw a line of equal pressure through 1, meeting a line of equal volume through 2 in 3. Then T_1, T_2 and T_3 may be found by calculation, or by finding a fourth proportional to P, R, and V, by construction. By these means we obtain the three isothermals, T_1, T_2, T_3. We may select the point 1 on T_1 at any convenient place, since it is only the *relative* positions of the points we desire. Then setting our *constant pressure curve* at T_1, we draw by means of it the line 1 3; this determines point 3 Now take the *constant volume curve*, set it at temperature 3 and draw the line 3, 2. This fixes the point 2. For an accurate determination of the amount of heat added or removed in passing from 1 to 2 it is necessary to take intermediate points tolerably close together, unless the line joining them is some determinate path. However, in the heat diagram the height is so very much larger than the width that very little error is made in treating it as a trapezoid and obtaining its area by multiplying its width (the change in entropy) by the average value of T.

We may note: (1) If the point 2 falls to the right of 1 on the $T\varphi$ diagram, heat is added in passing from 1 to 2. (2) If 2 lies to left of 1 heat is removed in passing from 1 to 2. (3) If 1 and 2 are on an isothermal, we should have found $T_1 = T_2$, and the point (2) would have been found by the same construction. (4) If 1 and 2 are on an adiabatic, the line of constant volume would have intersected T_2 on the vertical through (1).

In applying this method to an ordinary indicator diagram a practical difficulty would be encountered, from the fact that the scale of the diagram would be variable. We can easily calculate the entropy in passing from 1 to 2, and thus avoid the necessity of using an auxiliary point 3.

The entropy, or distance between the two verticals, is obviously the sum of the projections of the curves 1 3 and 3 2, considering the latter as negative, since it is drawn backward.

Now, the projection of the constant pressure curve 1 3 is $m \log_e \frac{T_3}{T_1}$, which may be written $m \log_e \frac{V_2}{V_1}$, since the pressure being constant during this period the temperature varies as the volume, and V_3 is the same as V_2.

The projection of the constant volume curve 3 2 is $-n \log_e \frac{T_3}{T_2} = n \log_e \frac{T_2}{T_3}$, which may be written $+ n \log \frac{P_2}{P_1}$, since the volume being constant, the temperature is proportional to the pressure, and $P = P_1$. Hence

$$\varphi = m \log_e \frac{V_2}{V_1} + n \log_e \frac{P_2}{P_1}$$

By means of this equation and the relation $P\,V = RT$, we can examine the heat changes of, for example, a gas engine diagram. Such an examination of an actual diagram from a Hornsby-Akroyd oil engine is given in Fig.

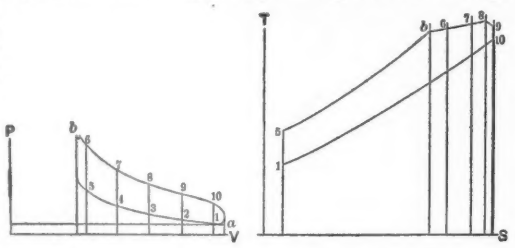


Fig. 5.—Transfer of Gas Engine Card to Entropy Temperature Diagram.

5, the values of T and φ for ten points on the curve having been calculated.

Some uncertainty attaches itself to the value to be assigned to m and n. By a process of approximation usual in this connection, and which cannot be far from the truth, the value of m has been taken as .246 on the compression curve and .26 on the expansion curve, while n is taken at .176 on the compression and 189 for the expansion curve. One of the conveniences of this method is the fact that we can draw our diagram to any convenient scale without assuming any value for T. When subsequently a value is either ascertained by experiment or assigned, the scale of T may be written in the same diagram, and, of course, serve for any other value of T by simply noting the change of scale.

In the same manner ordinary logarithms may be used in calculating φ, and any convenient scale for plotting the results and for numerical results, the actual value of the entropy scale can be readily ascertained. From the table of values it is evident that the compression curve is practically an adiabatic, the slight accession of heat from the warm cylinder during the commencement of the stroke being compensated by the rejection during the latter part of the stroke, and both being too small to be shown on the heat diagram with the scale used. While the bulk of the heat is added at the time of the ignition, sufficient is added during the time of expansion to carry the expansion curve above an isothermal. The heat due to this retarded combustion is really very much greater than the figure shows, since, during this time, heat has been escaping through the walls.

The diagrams representing the theoretical heat relations in the various types of internal combustion engines are very easily drawn, and will, on the face of them, demonstrate the fallacy of a number of popular ideas, such as, for example:

(1) That the Carnot cycle has any significance, whatever, as a measure of the efficiency of the ordinary Otto cycle. It is not unusual to insert the enormously high temperatures obtaining in the gas engine in the ratio

$$\frac{T_1 - T_2}{T_1}$$

and from the result thus obtained argue that the gas engine is theoretically capable of utilizing 70 or 80 per cent. of the heat supplied.

(2) That a Carnot cycle, if obtained, must necessarily be more efficient than the Otto cycle, with the same ratio of initial compression.

(3) That the heat flowing into the jacket, if suppressed, would be converted into work. It would be seen that the effect would be to throw the bulk of this heat into the exhaust, where it belongs.

Comments by Prof. Sidney A. Reeve of the Worcester Polytechnic Institute.

The science of thermodynamics has undoubtedly always been the bugbear of student life, the despair of the self-made man, and the universal object of a studied neglect on the part of the practical engineer which bore witness to a feeling of awe, scorn, or revenge toward it, whichever his individual experiences happened to dictate. The reason for this lies plainly, now that we can look back and criticise the generation which taught us, in the method by which it has been taught.

In all things there is a core which is valuable. It is the business of thought to strip from this core the husk of superficial phenomena and see the thing in its true light. In the teaching of thermodynamics, which is the law of transformation of thermal into mechanical energy, this has hitherto not been done. For, instead of studying and measuring and representing on paper quantities of energy, we have busied ourselves with dia grams of pressures and volumes, things which are only the wanton costumes in which heat-energy arrays itself before us, now in one aspect, now another.

Now the use of thermodynamics to the practical man is summed under two duties: The accurate measurement of present efficiencies; and the clear comprehension of future possibilities. To do this he must be able to carry clearly in his head, through all the intricacies of actual processes, two items in the problem; first, *quantity of heat;* and second, its *availability* for his purposes.

These two items are not shown on the ordinary indicator diagram, and they are to be deduced from it only by reasoning so obscure and mathematical that only the man frequently brought into contact with it can retain it in his head. In the entropy-temperature diagram, on the other hand, these items do appear as geometrical quantities, to be measured by scale and planimeter and as easily "thought through" as are the areas of cut and fill in a cross-section diagram. The horrible maze of hyperboloidal curves, whose only reason for existence seems to be "mental drill," gives way to a proposition as simple as that 1 lb. of water falling 10 ft. will develop 10 ft.-lbs.

It is in aid of the emancipation of man from this burden of complexity that Mr. Geo. Richmond brought the subject before the Am. Soc. M. E. Of the paper itself nothing can be said except praise, so skillfully did he compress a simple topic of unlimited application into a very limited space. Of course, many things might be added, but amongst them the following seem of chief importance.

In designing, or even merely owning, heat engines, it is important to keep clearly before one the possibilities for improvement. For this the indicator has been so useful, that its "points" are matters of rule of thumb with every practical man. But there are many such possibilities which the indicator card either takes no notice of or else exaggerates or under-estimates; it never measures them truly, as to quantity. But this is just what the entropy-temperature diagram does. Every fault, every gain, every possibility in efficiency is shown up in its true light at a glance, and can be measured by planimeter for accurate record.

A man tests an engine at great trouble and expense. What has he got in return? A water-rate, a fuel rate, friction loss, etc., etc. What are they worth to him? Nothing more than are the returns from the last horse race, unless they teach him how to better matters in the future.

Let him analyze his results on the entropy-temperature method, however, and all is different. Has he been testing a new valve motion which involves more clearance, has he been introducing new cylinder proportions, new jacket drainage, new anything which involves some gain and some loss,—in any case the entropy-temperature diagram shows up and accurately measures the gain and the loss, where one may be swelled and the other pared a bit. Does he propose higher steam pressures in a steam engine, more compression in a gas engine, pre-cooling in a refrigerating machine, the diagram will tell him what he will get for what he knows he must pay.

And this analysis is neither difficult nor tedious. A day's draughting will apply it to any engine test, the data once known. So satisfactory are the results that I confidently predict the day when every engineer will know the "points" of a good entropy-temperature diagram as well as he now does an indicator card.

As an aid to clear thought it is unequaled. The writer is free to confess that he never really understood thermodynamic problems until he received its aid. So true is this that his pupils are now taught to think in and rely upon the entropy-temperature diagram of all the different heat-engine cycles, solving problems in actual and possible efficiency, before they use the pressure-volume or indicator card at all. The latter then comes in in its true light—as a special manifestation of the cycle in a special direction with a special working substance, and in consequence, as liable to be misleading. The results so far are so gratifying that he almost wishes himself fifteen years younger and a tyro again, that he might have a fair start.

How much more lucid and valuable would have been the comparisons of the results in Professor Thurston's paper on "Multiple Cylinder Steam Engines," before the American Society of Mechanical Engineers, and published in the *Railroad Gazette*, had they been made by means of the entropy-temperature analysis.

Detroit Improved Lubricator with Tippett Attachment.

The engraving shows the Detroit locomotive lubricator with tippett attachment. During the past two or three years the question of getting the oil to the valves and cylinders regularly has been widely discussed. It is admitted that with the ordinary lubricators the oil does not go to the wearing parts regularly, especially when working with full throttle. The back pressure in the tallow pipes arrests the progress of the oil which is continuously delivered into the tallow pipes by the lubricator and holds it there until something occurs—such as the closing or partial closing of the throttle—to disturb the equilibrium existing in the tallow pipes. At such time all or part of the oil and condensed water being held in the tallow pipes would pass down into the steam chest. Thus, with the ordinary lubricators, the valves would be occasionally flushed, but would not be regularly oiled.

Among the devices proposed to overcome this difficulty the tippett attachment is simple and effective. It consists of a pipe leading to the dry pipe within the boiler, and communicating with the two tallow pipes. As soon as the throttle is opened an extra current of steam is admitted into the tallow pipes, which entirely overcomes the back pressure and creates a constant current in the tallow pipes toward the cylinders, as long as the throttle remains open. Thus, each drop of oil, as soon as it rises through the sight feed glass, is carried by this current to the wearing parts. When the throttle is closed this extra current is shut off so that no danger can come from it. These lubricators, with tippett attachment, are in service on several of the leading lines and are giving such satisfactory results that they are being specified for attachment to new locomotives. Where they are used, the efficiency of the engine has been increased, without increasing the quantity of coal used, and on account of the perfect lubrication furnished to the valves the reverse lever can be operated very easily.

New Automatic Gear Cutting Machine.

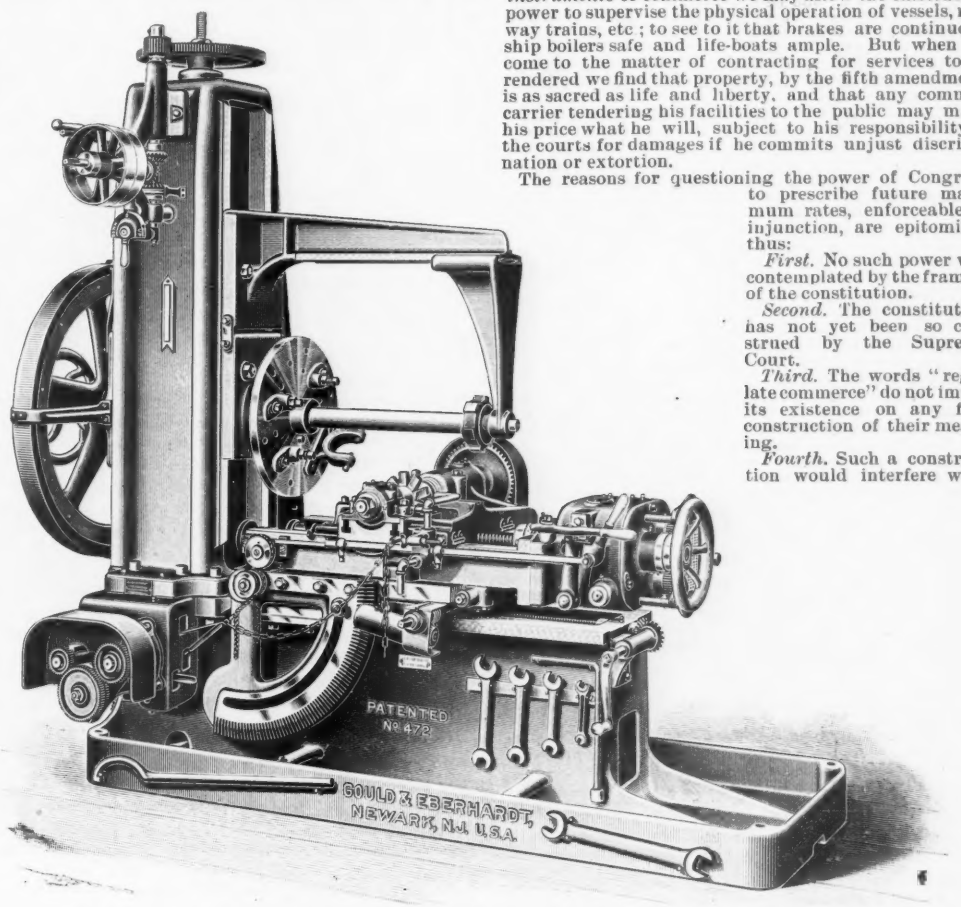
There have been but few attempts made to build entirely automatic gear cutting machines for cutting spur, bevel, worm and face gears of large dimensions. To meet this four-fold requirement with one machine, Gould & Eberhardt, of Newark, N. J., have brought out a gear cutter, shown in the accompanying engraving. The demand for such machinery is steadily increasing with the same rapidity with which the untrue and noisy cast gearing is giving way to cut gears. Not only is there a demand for machinery for cutting large spur gears, but cut bevels of large dimensions are also in demand, as well as are the worm and face gears.

This machine has an enormous range, and is intenedd to cut gears up to 74 in. in diameter, 14-in. face and from ¼-in. to 3-in. circular pitch. In this machine, its makers have introduced the 2-in. cutter mandrel and consequently the large diameter cutter. The advantages of a cutter of large diameter are apparent, and the only reason they are not in universal use is possibly on account of the amount of power required to drive them. Gould & Eberhardt are now making a line of machines in which the driving power has been greatly increased, and were thereby enabled to make advantageously the large diameter cutter. These large cutters can either be fed into the blank much faster, or if preferable to run at the same speed as the small size, and thereby last much longer.

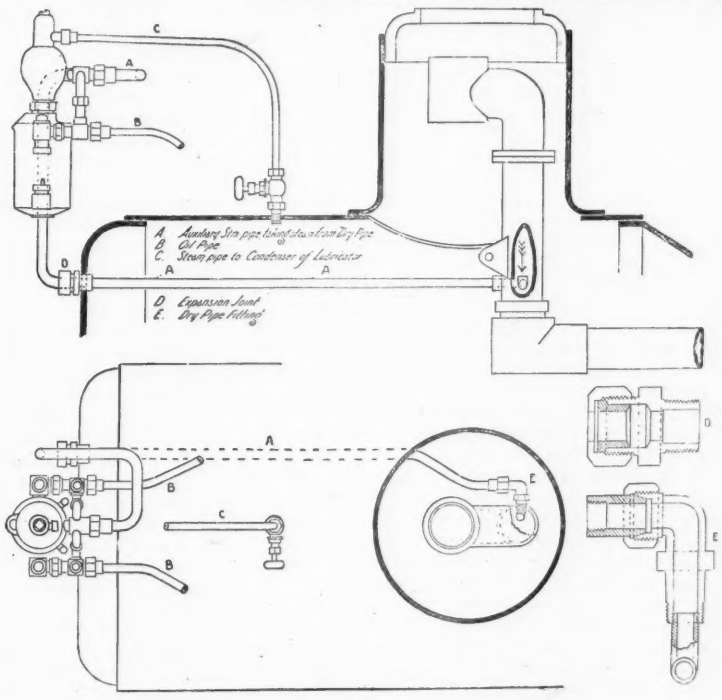
The feed screw terminates directly back of the cutter in the cutter slide, and consequently the thrust is taken in a direct line. The machine is so constructed that the cutter slide cannot feed forward, unless the divisions of the worm wheel have been fully completed By the use of a double screw arrangement the chips are carried from the slide and deposited automatically in the base of the machine. Around the entire base there is cast a large oil pan which not only catches the drippings from the machine, but also serves as a receptacle for oil when working steel. The oil is drawn from this pan and fed to the cutter by means of a centrifugal pump.

By the use of a crank handle which moves a shaft and connects with a segmental bevel gear at each side of the machine, the slide can be raised uniformly, according to graduation, to any upright position up to 90 deg., for cutting bevel or face gears. By the swiveling of the slide to the right or left and use of the power raising and lowering device, worm gears up to 74 in. in diameter can also be cut. An overhanging support holds the gear rigid by supporting the outer end of the work mandrel. A gear case in column of machine furnished ample room for the various change gears, and necessary tables indicate how to place them properly.

The work mandrel can be raised and lowered by either power or hand. Adjustment of all the important parts is made according to graduations which read very plainly to .001 of an inch, and consequently can be gaged much finer.



New 74 × 14 Inch Automatic Gear Cutter Machine—Built by Gould & Eberhardt, Newark, N. J.


A. Auxiliary Steam pipe taking steam from Dry Pipe
B. Oil Pipe
C. Steam pipe to Condenser of Lubricator
D. Expansion Joint
E. Dry Pipe Fitting

Detroit Lubricator with Tippett Attachment.

Should Congress Legislate on the Subject of Railway Rates?*

Mr. Walker considers the following three phases of this question: *First.*—That of constitutional right. *Second.*—That of practical common sense. *Third.*—The demand for additional power in this direction in the last report of the Interstate Commerce Commision.

On the question of constitutional right Mr. Walker quotes an interesting array of authorities and eliminates every consideration save the naked definition of the phrase "What is it to *regulate* commerce?" This clause he contends must be construed so as to harmonize with the Fifth Amendment, which restricts the powers of Congress, much as the powers of states are restricted by the Fourteenth Amendment. In regulating the *subjects* of interstate and foreign commerce, we may concede a right to promote the exchange of commodities, when deemed desirable for the common good, and to suppress the exchange of such as are dangerous to life, health or the general prosperity; but not to forbid traffic in legitimate property, such as the necessaries of life, its comforts and its luxuries. In regulating the *persons engaged in* commerce, we may admit a right to examine and license shipmasters, engineers, etc, for the safety and protection of all concerned, but not to exclude any citizen or designated class of citizens from the purchase of a seaworthy ship, or of wagons, or railroads, or their employment in commerce. In regulating the *instruments* of commerce we may allow the existence of power to supervise the physical operation of vessels, railway trains, etc; to see to it that brakes are continuous, ship boilers safe and life-boats ample. But when we come to the matter of contracting for services to be rendered we find that property, by the fifth amendment, is as sacred as life and liberty, and that any common carrier tendering his facilities to the public may make his price what he will, subject to his responsibility in the courts for damages if he commits unjust discrimination or extortion.

The reasons for questioning the power of Congress to prescribe future maximum rates, enforceable by injunction, are epitomized thus:

First. No such power was contemplated by the framers of the constitution.

Second. The constitution has not yet been so construed by the Supreme Court.

Third. The words "regulate commerce" do not imply its existence on any fair construction of their meaning.

Fourth. Such a construction would interfere with and destroy the rights of property, assured by other clauses.

Fifth. The clause cannot be so construed without involving the power to regulate the rates to be charged by vessels engaged in commerce with foreign nations, and also prices generally in commercial transactions.

If a power to fix prices is derivable from the word "regulate," it must apply as well to the sale and purchase as to the transportation of the subjects of commerce; and it is not perceived how any decision, founded upon such a definition of the verb, can stop short of including the price of cotton in its sale as well as the price of its transportation.

The question whether or not the particular industry in question is "affected with a public interest," made prominent in the Granger cases, so called, has nothing to do with the subject now in hand. Those decisions were concerning the powers of state legislatures, of the United States, of the common-law jurisdiction heretofore possessed as to such matters by the courts of England and of the several states. But there is no such common-law jurisdiction of courts to award the charges that may be made for future transportation. If Congress is to exercise administrative authority to that end it must produce a warrant under the Federal constitution. The word "regulate" is often spoken of as synonymous with "control." But the constitution does not use the word control. It uses only the word "regulate." . . . Railroad franchises, with few exceptions, are state grants. The state gives them being. In effect they are the works of the several states, being constructed under their direct authority. So far as the Congress or the courts of the United States are concerned, each railroad company is a citizen of one or more states, and must be legislated about or impleaded as such a citizen, always under some express grant of a power to be found within the four corners of the Federal constitution.

But "suppose Congress has the right to fix future railway rates upon interstate traffic, is the exercise of such a power desirable or wise?" If Congress can confer such a power upon a Commission, it can exercise it directly by act. To see where this would lead us one or two concrete cases may be suggested. Suppose a member from Georgia should introduce a bill to reduce the rate on marble to 25 cents from points in Georgia to Chicago, and suppose, also, that the rate on marble from Vermont to Chicago is 50 cents. The proposed reduction would shut out Vermont marble from a large part of its present territory. New England would naturally rally to the defense of Vermont, and the rate on marble would become a political issue, with locality arrayed against locality, with bargains to be made, with personal interests to be promoted. Or, suppose, again, that the rate on lumber from Wisconsin and Michigan to Kansas and Nebraska should become a matter of Congressional legislation, as compared with lumber rates from Arkansas, Louisiana, Mississippi and Oregon to the same territory? Or suppose a bill should be introduced to prevent railroads from transporting oranges from California to New York at less than $1.50 per 100 lbs., on the ground that such transportation has a tendency to injure the orange growers of Florida; or to reduce rates from both states in order to exclude fruits from other countries. Such examples need not be multiplied. There is no citizen who would not deprecate the introduction of such questions into the halls of Congress. Nevertheless, such legislative experiments are in sight if we once concede the propriety of Congressional legislation upon railroad rates.

The discussion preceding the enaction of the Interstate Commerce Law, clearly showed it was not the intention of Congress even indirectly to confer such

* Extracts from a synopsis of a paper by Aldace F. Walker, Chairman of the Board of Directors of the Atchison, Topeka & Santa Fe.

powers upon the Commission. On the contrary, the prevalent idea then was that the fixing of rates by legislation was impracticable. This proposition is as true today as it was ten years ago. . . . After several years of laborious genesis the Commission has developed an idea that it has rate-making powers, and, although the Supreme Court has fully and finally decided that no authority to nominate rates was conferred on the Commission by the Interstate Commerce Law, an effort is to be made to secure legislation looking to this end. But why? Let us look at the matter seriously. What has occurred since 1887 to make this proper legislation for Congress to undertake? Have railway rates advanced since 1887? Has extortion been committed? Have we not the lowest rates in the world? Have not bankruptcy and reorganization been the almost universal experience of railroad companies?

But, some one says, when unjust discrimination is charged the Commission should have power to say what reduction is required to overcome the discrimination. But the injured party has a right of action, the same as for any other pecuniary injury; even more, for he may elect between proceeding for damages or for restraint; and the Commission may not be infallible.

There are two ways in which railroads may be managed; one is the bureaucratic method of countries having State railways, in which competition is set aside so far as possible by divisions of territory and of traffic, and rates are named upon somebody's idea of what was thought proper when the roads were opened. The other is the competitive system, under which varying competitive forces determine from time to time the maximum rates that can be charged, and the desire to attract business reduces these maxima freely. The latter system is that of countries subject to the common law. To go over to the bureaucratic system is contrary to the spirit of our institutions; it is worse than that, for it would endanger our national progress. Under rates controlled by competition our country has expanded and developed beyond what any other nation would think credible. Rates have been constantly reduced, and doubtless the flexibility of rates in their adaptation to business conditions and the continual opening of new enterprises, channels of trade and markets have been largely due to the fact that no bureau has supervised railway traffic.

It would be a sorry day for our country were a rate-making power given to any possible tribunal. Its mere existence would threaten all energy and enterprise. Its exercise would either overturn competitive conditions, which would be ruinous, or it would acknowledge them, which is the present system.

In view of the fact now generally conceded, that the prohibition of pooling was unwise and has prevented the obtaining of many good results hoped for from the passage of the Interstate Commerce Law, it seems probable that Congress will be compelled to authorize pooling agreements as an aid to the regulative statute. The prohibition of pooling made unjust discrimination inevitable on the largest possible scale. But in connection with the proposal to correct this admitted mistake it is said that rates should be subjected to absolute and effective control. . . . But it is an entire fallacy to suppose that the rate to be charged on any given traffic is subject to the decree of the railway traffic manager or even to the decree of groups of traffic managers. They can reduce rates, but except in rare and peculiar cases they cannot make them higher than the maxima forced by competitive conditions, which control railway rates in substantially every corner of the land. And the rare and peculiar cases will either presently correct themselves or can be corrected through existing machinery to that end.

We may look to the past to learn just what the Commission's present demands would lead to. Most of the cases in which the Commission, in the previous misconception of its powers, has undertaken to name a rate which should not be exceeded have been occasions where the real difficulty was excessive competition. For example, the lumber rates in the Northwest; an order was made that a certain railroad should not charge above a certain rate, amounting to a reduction of two or three cents per hundred weight. The road in question was quite willing to make this reduction, hoping thereby to increase its tonnage; but its competitors, who were carrying lumber from other points to the same market, at once reduced their rates by the same amount, so that the shippers by the first line got no relief, while the railroad was robbed of its revenue without any useful purpose being subserved. This was a case where the Commission undertook to correct what it considered to be an unjust discrimination. But does not the result prove that in fact there was no unjust discrimination? If a certain condition is forced by competition, even though upon inspection of distance-tables and tariffs it appears to be unnatural and unfair, the state may safely assume that the apparent discrimination is the result of inherent disabilities on the one hand or advantages on the other. Competitive forces are too intricate and delicate to be controlled by the insertion of a crowbar here and there. There are many apparent evils in the world which benevolence is unable to assuage. We must determine such general lines of policy as are likely to promote the greatest good of the greatest number. In the matter of railway rates there can be no possible question that the true policy consists in remitting their control absolutely to natural laws without interference by state or nation.

The control advocated and asked for by the Commission is far beyond what has been provided for in the Foraker bill. The powers outlined in its annual report and submitted to Congress for adoption and approval cover all that the wildest advocate of a bureaucratic system could desire. They would confer upon the Commission absolute power over all interstate railway rates. Not simply over the rates upon the traffic subject to the proposed pooling agreements, but power over the rates upon all traffic subject to the law. The power desired is the most enormous ever conceived by human intellect. It is now exercised through the agency of thousands of experienced men, each representing not only the interests of his line, but of the customers of his line, whose increased business is also his increased business. It is calmly proposed to substitute the judgment of five men—of three if the five do not agree—trained as lawyers, representing five localities only, with a power to ruin industries, to boom towns, to "determine whether the Kansas farmer shall burn his corn for fuel or send it to the market"; and with power at the same time to make or break every railroad corporation in the land, to send any railroad stocks or bonds up or down in the stock market, to control importations of every kind and to limit all exportation (which, by the way, is involved in rulings already made by the Commission), to exclude Baltimore or Boston or any other city from the transaction of export business by changing existing differentials, to array North against South and East against West.

Our laws at present require impossibilities. It has been held that the Anti-Trust Law forbids railroads to use the only practical method for doing the things which the Interstate Commerce Law commands. And it is an admitted truth that the Interstate Commerce Law seeks to enforce competition by the mandate of the statute, and at the same time punishes as criminal misdemeanors the acts and methods by whith competition is ordinarily effected. The result, as has been tersely stated, is that in many localities and with reference to many commodities, a man who obeys the statute law can "neither operate a railroad nor ship over a railroad." This is the pass to which this industry has been brought by inconsiderate legislation. Practical and commercial conditions have been ignored. Contradictory laws have been enacted. Prompt Congressional legislation is absolutely required. This action must cover two fundamental points. First, the Anti-Trust Law must be so modified that railroads may act together in performing the requirements of the Interstate Commerce Law; second, the Interstate Commerce Law must be so amended that railroads may apportion the earnings of common traffic, and thus make possible the elimination of unjust discriminations from the transportation service.

Average Life of Cross-Ties in Colorado.*

BY WILLIAM ASHTON,
Division Engineer, Union Pacific.

In renewing cross-ties they are usually gone over but once a year, and all ties left in the track at the time the renewals are made are supposed to be good for at least one more year's service.

Most of the ties now used in Colorado are of native pine and spruce. A few oak ties are brought into the state for use under very heavy traffic and on sharp curves, but, by the aid of tie-plates, closer spacing and better rail-braces, aided by the wider rail-base and stiffer rail, we are now enabled to use pine and spruce native ties at points where their use would have been considered unsafe a few years ago.

When I began railroading it was thought proper to use soft wood ties only on tangents. In Kansas and Nebraska, as late as 1881, my instructions, when in charge of track-laying on branch lines that were never expected to carry heavy traffic, were to the effect that soft wood ties, such as cedar, cypress, or pine, might be laid in tangents—on 1 deg. curves every third tie must be oak, on 2 deg. curves at least one-half the cross ties must be oak, and on 3 deg. curves all ties must be of oak. As we had no curves sharper than 3 deg., I can only guess at what we should have done had we struck an 18-deg. curve. In those days, however, we used only 2,640 ties to the mile, and 50 to 52-pound rail. Now we frequently use 3,200 ties per mile, and seldom less than 2,900, while very little new rail is being rolled of a less weight than 65 pounds per yard, if intended for standard gage track: while the rail rolled in the year 1895 for standard gage will probably average at least 70 pounds per yard in the West and heavier in the East. While many more ties are used now for a mile of track than a few years ago, I fail to notice a reduction in the size or quality of the different classes. I think the oak ties we get now are fully as good as those we got 15 years ago, and the same may be said of ties of other woods.

In my opinion ties are now better cared for than they were, and last longer than they did a few years ago. The increased strength of the rail distributes the weight over a greater number of ties, and much more evenly, than when lighter rails were in use. As a result the ties get less individual punishment under the traffic, even though it has materially increased in weight per lineal foot of train, and although our tracks are subjected to much greater loads and speeds than they were a few years ago. I believe the track has fully kept pace with the increased weight and speed of trains, and is fully as safe as the poorer track was at the slower speeds. . . .

Under ordinary circumstances my experience on the lines in Colorado has been that ties of Colorado pine, balsam, and white spruce will last in track 3½ to 4 years under ordinarily heavy traffic. Under light traffic, on a well-tied track, they will probably average 4 years. On our main line we usually take out about half of these ties after three year's service and the balance the fourth year. On sidings and spurs, where they had very little traffic over them, where no renewals of such ties would be made until the fourth year, yet if, during the third year, this track had been subjected to a fast heavy train, many of the ties would have been found broken and possibly some of them crushed. We have alkali lands where the ties seem to burn out; that is, there seems to be something in this soil that destroys the fiber of the wood, causing it to become worthless in respect both to its tensile strength and to its resistance to crushing. The ties enumerated above often last only two years in this soil.

Yellow spruce, as found in Colorado, lasts in the track about four years. Red spruce is the best of Colorado tie timber. It is a strong, firm wood, holds spike well, and lasts usually five years, and in some cases will average 5½ and even 6 years. Colorado timber, cut at a high elevation, lasts, in some cases, fully one year less than that cut lower down, especially if laid at a considerably less elevation than where it grew. . . . If it were not for the old wooden tie to fall back on, we would have metallic ties of a pattern and efficiency that would give little cause for complaint; but I do not look for the general adoption of this kind of a tie until they can be not only furnished at a cost which will compete with wooden ties, durability considered, and until they are made of such form as to admit of their being put in track without having a machinist for a section foreman. I fail to find any reason for expecting that the adoption of metallic ties will materially reduce the cost of track maintenance, except in the matter of renewals of ties; and even with metallic ties, we shall have to keep practically the same kind of track forces as we do now, with perhaps one or two less men on a section during the summer. We will still have to depend on common labor. Therefore we want a metallic tie that can be handled by this class of labor, or a tie that will call for so little attention that we can afford to hire special skilled labor to handle and look after them. We shall require the same amount of lining, ballasting, track raising, widening of banks, cutting of weeds, draining of cuts, and other miscellaneous work of this character as heretofore. This work will have to be done by cheap labor, and this labor is what will be called on to put in metallic ties.

*From the *Journal of the Association of Engineering Societies.*

The Mayor of New York on Rapid Transit.

In his first message, Mayor Van Wyck, of New York, speaks as follows regarding "rapid transit":

"It was expected that the Board of Rapid Transit Railroad Commissioners would furnish a plan not only feasible as to construction, but also entirely relieved from any features which might either provoke determined opposition or cause any considerable delay.

"It is to be regretted that the court proceedings recently had regarding the plan submitted and the very important and far-reaching questions then and there raised made it apparent that some other form of relief must be decided upon or our justly impatient people will be required to wait during the very indefinite period, covering certainly a number of years, before a final decision can be had in the tedious litigations already begun and threatened. Nor is it at all certain that, after such delay, they will not find, at the end, as the only outcome, additional and more serious difficulties.

"Our citizens will no longer tolerate, much less excuse, delay upon delay at the cost of not alone the comfort and convenience of the people, but also the increased valuation which, in a considerable degree, would add to the public revenues if the rapidly growing districts most directly interested were furnished with greater and improved facilities for travel.

"Let us make the best possible use of such of our present facilities as, by improvement and extension, can be made available at a fixed and definite time for some relief in the direction of the popular demand.

"To my mind, there can now be urged no sufficient reason for the continued employment of the locomotives now in use on the elevated roads. . . . And again the number of through express trains should be considerably increased, their running time improved and their use continued throughout the day and night. . . . The trunk elevated lines should be extended so as to furnish more convenient communication with ferries; and, most important of all, these lines should not be confined, through the greed or indifference of corporations operating them, to the thickly populated, and therefore profitable residence and business districts.

"The corporations should be compelled to continue the present routes to the more sparsely settled and more distant localities, even if for a time some loss is entailed upon them by so doing.

"It is essential to the prompt relief sought by the people that the time allowed for the completion of the improvements here suggested should neither be unreasonable nor unlimited. A definite period should be fixed, within a fair and sufficient limit."

Pinners Point Warehouse of the Southern Railway.

The Southern Railway Company has recently completed at Pinners Point, Va., a large warehouse for storing freight for foreign shipments. The floor is 270 ft. × 718 ft., the building being frame, single story, covered with four-ply felt and gravel roof. There are two tracks running in the center of the building and one on the outside from which freight is loaded direct from the car in which it came to the ship alongside, and vice versa.

A system of water pipes has been put in with hydrants and hose throughout the building, at several points outside of it, and on the roof, so that fire starting at any point can be reached with several streams of water at short notice. A heat alarm system has been installed and connection made with the pump house and firemen's quarters, with a set of signals which indicate the place of the fire. The building is well supplied with windows and the interior is painted white, so that in daytime every part is well lighted and at night arc and incandescent lights located systematically illuminate the building.

The building and the tracks approaching it rest on about 6,000 piles, pine, oak and cypress, from 50 to 75 ft. long. These are tied together by 12×12 pine timbers, drift bolted to each pile, by heavy iron rods extending across the base of the building, by a system of strings and ties inside the close row connected with double lines of pine ribbons outside the close row, and by many bolts. No piles were creosoted or otherwise treated for preservation against attacks of the teredo.

The slips each side of the pier are 200 ft. × 800 ft., and when completed there will be 27 ft. of water at low tide, enabling ocean freighters of deep draft to safely receive full loads at the warehouse without danger of grounding. The excavation, which for the most part is from 25 to 27 ft. deep, is being made by suction dredges discharging under the warehouse and on low-lying land in the rear.

There are about 15 miles of track in the yards adjacent to this and the three other warehouses of this company. The entire floor space of the buildings is about 13 acres. The large warehouse was completed the first of December last. It is known as No. 5, and is said, whether correctly or not, to be the largest single-story warehouse on the Atlantic coast. The first pile was driven June 4.

Foundations for Signal Work.

As the value of interlocking and signaling becomes more appreciated the details of construction must necessarily receive closer attention. The earlier installations and, in fact, most of the present interlocking plants have used an oak frame for supporting pipe carriers, bell cranks, compensators and horizontal wheels, and it has been the general practice to dovetail the sides into the top, securing them by a bolt through the top and tongue on the side. Perhaps this is the worst possible form of construction, for the reason that the dovetail, although it may be made ever so close when the foundations are sent out from the factory, will shrink and draw away so that little if any strength is secured through the dovetail. The greatest evil of this form of construction, however, appears to be in the fact that the ends of the sides are exposed to moisture, and water is bound to settle in and be held by the dovetail, and in consequence the life of the whole foundation is considerably shortened by decay where the dovetail joint is formed.

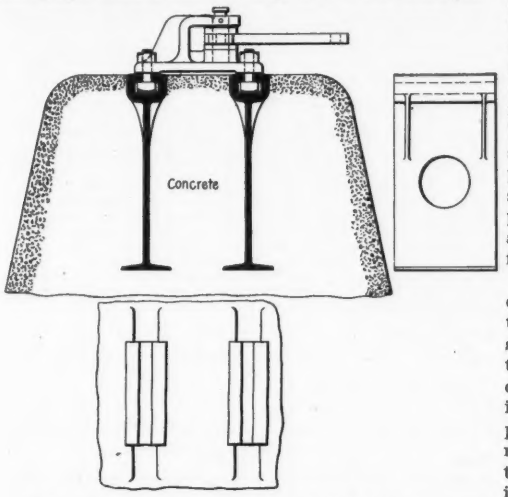


Fig. 1.—Hansel's Foundation for Bell Cranks, Etc.

If wood is to be used at all for foundations a simpler and much better form of construction is that shown in Fig. 2. This style is used at the State Line interlocking plant, which is the largest mechanical plant ever constructed in this country. The ends of the upright sides are protected by the top.

Between the years 1888 and 1892 perhaps more signal work was installed in the United States per year than has been put in in any one year since that time and signal engineers who are charged with the maintenance of these plants now find themselves confronted with the unpleasant and expensive task of renewing these foundations at considerable cost. We believe the question of economical foundation for pipe carriers has been met in the multiple iron foundation illustrated in the *Railroad Gazette* of the 17th, describing the malleable-iron foundations designed and manufactured by the National Switch & Signal Co. of Easton, Pa. These foundations being on the unit system make it possible to group them in any manner desired and being of malleable iron and requiring no lag screws they are practically everlasting.

It is now the general practice to place bell cranks, horizontal wheels and compensators on an extra heavy foundation made of oak or pine, which is given additional temporary stability by being filled around the top with concrete. This, however, does not give satisfactory results for two reasons; the first being that the wood is constantly deteriorating, and the second that since the earth around the foundation is disturbed in preparing the excavation to receive the wooden foundation, the concrete which is placed around the upper half of the oak foundation, is not securely sustained, and as the earth settles under it it breaks away from the oak foundation, leaving it without substantial support. This fault is acknowledged by signal engineers. The concrete signal foundations illustrated in your issue of December 3, page 856, is certainly an advancement over the wood and concrete foundations before described, as is the design offered by the signal engineers of the Illinois Central, Michigan Central and "Big Four."

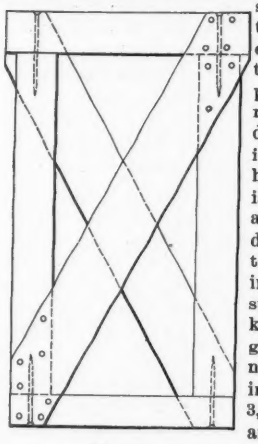


Fig. 2.

In the design referred to as illustrated in the *Railroad Gazette* and in other designs which have been submitted to us, we find an objection in the use of the wooden base, for since we are seeking to avoid the use of any material which through decay will deteriorate more or less quickly and require renewals which must necessarily throw a portion of the interlocking plant out of service for a short time and at the same time add to the cost of maintenance, we believe all wood parts should be avoided. It is also desirable to design this foundation so that in case the tracks are raised by ballast or tamping, as they frequently are, the foundation may be conveniently added to without disturbing the original concrete base.

Fig. 1 shows a longitudinal section of bell crank in place on a foundation made by imbedding iron piers in concrete. It will be observed that the bell-crank base rests solely on iron piers, forming in the head a T-shaped slot. The object of this slot is two-fold; it is difficult to locate a foundation in concrete so accurately that the location of the bell crank needs no adjustment on same in order to form perfect alignment. By means of the slots the bell crank can be adjusted. The second and most important feature of this slot is that in case it is necessary to raise the bell crank at any time in the future the bolts can be loosened and slipped out and longer bolts supplied. The additional height necessary may be secured by adding on more concrete, or if permanency is not desired the additional height may be secured by placing a wooden plank on the iron piers and permitting the bolts to extend through same, the same as illustrated in the article of December 3, before referred to as a design for original construction.

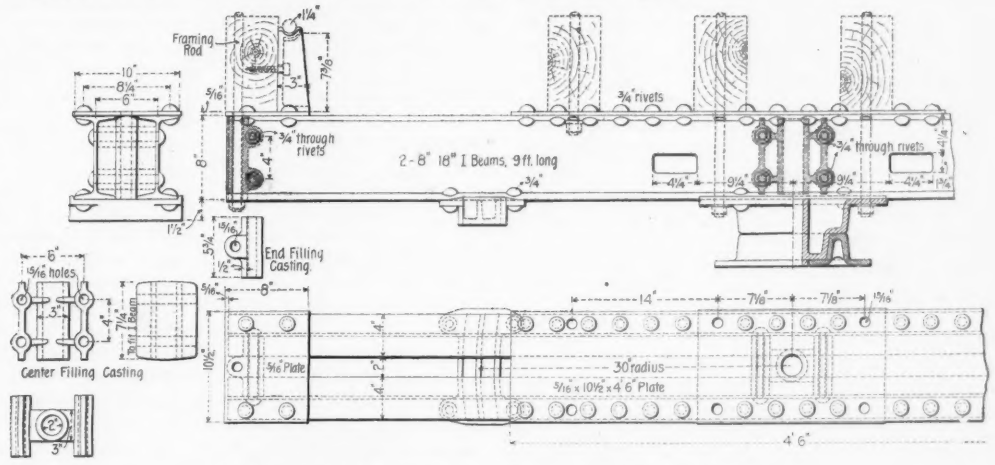
The same figure shows top of foundation ready to receive bell crank, and a side view of pier, and it will be noticed that owing to its width it offers the maximum resistance to any strain put upon the bell crank, and distributes same through the width of the concrete. A desirable feature of this design is the fact that these iron piers will be used uniformly for bell cranks, compensators or wheel foundations, and consequently it is necessary to carry but one style in stores. We believe that this method of combining concrete and iron, having the adjustable and interchangeable features above described for bell cranks, compensators and horizontal wheel foundations, together with the unit system of malleable-iron foundations for pipe carriers before mentioned, is an important advance in signal work, and although the first cost of the foundations themselves is more than if wood were used, the cost of labor for installing the iron foundations will be considerably less and the decreased cost of maintenance and renewals will, we believe, favor the use of iron foundations.

CHARLES HANSEL, *M. Am. Soc. C. E.*

DEC. 23, 1897.

Metal Body Bolster—Chicago Great Western Railway.

The accompanying illustrations show the details of a simple arrangement of body bolster designed by Mr. Tracy Lyon, Master Mechanic of the Chicago Great Western, which is to be used on the 36-ft., 60,000-lbs. capacity box-cars recently ordered by that road. The bolster consists of two 8-in., 18-lb. steel I-beams 9 ft. long, placed 6 in. center to center and joined at the ends and center by means of suitable cover plates and filling castings. The weight of the bolster, including the center and side bearings, is approximately 500 lbs. The "Barber" truck is the standard of the Chicago Great Western for freight equipment, and as this truck has a low frame it is possible to use a body bolster quite deep at the ends, for which reason commercial shapes can be used to advantage. The bolster has few parts, is easily constructed and can readily be repaired in any small railroad shop.



Details of Metal Body Bolster—Chicago Great Western Railway.

Rhodesia and its Railroads.

Last October *Engineering* (London) published a very interesting account of the Cape railroads. It would seem that much progress has been made in railroad building in South Africa during the past year, and that many more miles will be built during 1898. The most important of these extensions is the road between Buluwayo and Mafeking, now the most northern terminus on the Cape railroads. The road which has just been opened represents 587 miles, and has been built in 18 months. The rate of laying was generally about a mile a day, in some cases from 1½ to 2 miles. It was very difficult to haul sleepers or materials in advance, owing to the rinderpest, which carried off all beasts of burden, while the exceptional drought, was also a retarding element, so that from all points of view the construction was especially rapid. On the transcontinental lines of America the builders found ties ready to hand, but on the Buluwayo lines the ties had to be conveyed from Cape Town and passed on to the scene of work in advance by ox wagons or other road transport. The scarcity of water involved difficulties in survey and in construction, the annual rainfall being only 20 to 30 inches over Buchania and the Protectorate.

The line was first laid down on the map about three years ago, and there measured about 560 miles; when finally surveyed it was 587 miles. The line for the most part follows the contour, but little heavy earthwork having been encountered. The permanent way is of the standard section of South Africa. The gage is 3 ft. 6 in. rails are 60 lbs. weight of the ordinary T type with steel ties. These latter were imported from England and were necessary, owing to the fact that the wooden ties would be destroyed by the white ants. The steepest grade on the line (except for short distances) is 66 ft. per mile; and the sharpest curve is 11 deg. Generally, it may be said that the permanent way has been built to suit the heaviest engines that can be used. These, with tender, are of 70 to 80 tons weight, and will run at 15 to 20 miles an hour. This latter will ultimately be the speed of all trains, bringing Buluwayo within three days of Cape Town. The cost of carrying goods by wagon over the 587 miles, from Mafeking to Buluwayo, was over $500 per ton. By rail this would be reduced to about $25 per ton. For passengers, the cost by wagon was from $200 to $250, while the average railroad fare throughout the Cape is six cents a mile for the first class and four cents for the second class. A *train de luxe* will be introduced, to consist of a family suite, sleeping and observation compartments, with bath-rooms and barber shop and smoking, dining, parlor and observation cars. This Buluwayo Line will serve Matabeland, the country to the northeast. Rhodesia and Mashonaland will have the railroad terminus at Fort Salisbury, and will have as a port Beira, on the east coast of Africa, one of the best ports on the continent.

From Beira to the frontier of Mashonaland a narrow gage line, for which Sir G. Bruce and Sir Charles Metcalf are the engineers, and Messrs. Pauling & Co. contractors, is rapidly being completed through a difficult country, part of it dense jungle, where malarial fevers are serious. At Umtali, the frontier town, a new road will be commenced for the Mashonaland Railway Company and will extend to Fort Salisbury. This road will also be 3 ft. 6 in. gage. When the Beira road was started there were great financial difficulties, and the river Pungee was utilized for 55 miles westward from Beira. At that point a town was founded called Fontesvilla, where the railroad starts in the direction of Chimoio, and 75 miles has been built. Later the road was built between Fontesvilla and Beira, where it terminates on a pier. This pier is so constructed that the large liners can moor alongside.

The railroad is now being built westward from Chimoio and should be completed to Umtali early in 1898.

In Rumania the locomotives and many other steam engines are to be fitted to burn petroleum residuum. This fuel could be cheaply had from the Caspian oil wells, it might seem, as ships can sail directly from the western terminus of the Trans-Caucasian Railroad to Rumania, and the railroad from the wells to the Black Sea is but 536 miles long. Actually, however, the supply is to come from recently discovered oil wells in the Carpathians, on Rumanian territory. Rumania heretofore has imported nearly all its fuel (coal).

In its anxiety to be independent of other countries the Russian government has required that the railroads should order their rails and some other materials exclusively from Russian works. Strange to say, these works have charged uniform prices, which amounted to about twice the cost of foreign productions, unmindful of the fact that a very large part of these supplies must be bought by the government for its roads, and that by its guarantee of dividends it bears the burden of increased expenses on most of the private roads. Now it is said that the Minister of Transportation will have the orders for rails, etc., distributed among the several works accompanied by a statement of the maximum price it will pay, and if the works refuse to contract at so low a price, it will ask for and accept bids from foreign works.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The breakdown of the so-called "estimate" for the enlargement of the New York state canals has been used by a Western journal as a basis for a silly assertion that engineers' estimates in the United States are always wrong, while the "German and French engineers never make such blunders." The editor has apparently never heard of the Panama Canal, and he must be very credulous to believe that the Kiel canal engineers "estimated exactly to the cent of cost, and to the exact cubic yard of excavation and masonry." The charge is especially ridiculous in its application to the New York state canals, for the reason that if we are to take the word of the State Engineer and of the Executive Committee of the associated commercial bodies of the state, no engineer's estimate, in any proper sense, was made until the year following the popular vote to appropriate the $9,000,000. Whatever may prove to be the facts in regard to the part the State Engineer has played in this matter, there is in this case no foundation for the charge that American engineers "cannot estimate within a decent degree of any work, as is done abroad." There is one vital difference between the conduct of public works, in general, in the United States and Europe. In Europe they are, as a rule, actually under the direction of the engineers; in this country the common practice is to put them in the hands of commissions and boards and superintendents who are not engineers. It is thus unfair to attribute the cost of public works to a lack of ability or honesty among American engineers, of whom but a small proportion, unfortunately, are occupied with public works at all and still fewer have plenary powers over the works under their nominal charge. Fortunately some of our more important public works are actually directed by engineers and in most such cases the highest attainable degree of accuracy is reached, in planning, estimating, and economically executing them with results not inferior to the best work of private corporations, in this country or to the public works of any other country.

A Suggestion of Possibilities in Fuel Economy.

An examination of the annual reports of the Southern Railway for the years 1896 and 1897 gives a striking example of some of the possibilities in saving fuel. In 1896 there was a decreased cost in all fuel used, in proportion to work done, as compared with 1895 of about 11 per cent. In 1897 there was a further decrease of 10 per cent. as compared with 1896. In dollars the saving was $379,717 in the two years, which, of course, includes other economies, but the bulk of which must be traceable to economy in the use of fuel. The engine miles gained more than 20 per cent. in the two years, while the cost of fuel per engine mile fell from 6.48 to 5.21 cent.

This saving has not been due (except in small part) to the reduced price of coal. From the United States reports of mineral resources we find that the decrease in cost of coal in Alabama and Tennessee for those years was 3 and 4 per cent. respectively. The company must use a great variety of coal, some of it of the highest grade and some of the lowest. Precisely how the savings have been made we are not able to tell through want of complete knowledge. We may suggest, however, that methods not unknown to other roads have been applied.

For instance, switch engines and branch lines can often be economically supplied with coal costing 50 per cent. or sometimes even 33 per cent. of the value of main line fuel, and on some lines this use of cheaper fuel may amount to as much as 25 per cent. of the gross consumption. Again, coal, however good, is put into the firebox by men who, in the nature of things, know but little of the requirements of combustion and the peculiarities of coal outside their own daily experience. Thus, it is important that after a fireman learns that he gets a particular coal at a particular chute this experience be made valuable to the company by furnishing that same kind of coal as long as it is practicable and by seeing that the coal from each mine is kept uniform in quality and that the firemen have a chance to work with a fuel the value of which they have learned. Furthermore, it is sometimes practicable and economical to use a cheaper coal for stationary engines and pumps than is used on the locomotives. While this economy amounts to but little in each case the sum of the economies may be considerable.

On many of the railroads of the United States the fuel cost is about 10 per cent. of the total working cost; or, put into dollars, the cost of fuel for all the railroads of the United States is probably not far from $75,000,000 a year. We need not speculate as to what would happen if all the railroads were as successful in saving fuel as the Southern has been, or, we may add as successful in saving in cost of lubrication as the Pennsylvania has been.

The New York State Canals

The recent developments regarding the New York State canals strike much deeper than a mere engineering blunder and that at first sight appears to be a colossal one. According to the testimony of the State Engineer in his response to the Chamber of Commerce inquiry, it was well known and "understood" that the estimated cost of the proposed improvements submitted to the Constitutional Convention in 1894 was based upon no proper data and was practically mere guess-work. That estimate purported to cover the entire canal improvement and amounted to $11,573,000. But subsequently the State Legislature guessed again and concluded that a round $9,000,000 would just do, and the people were asked to (and did) vote that sum in 1895 for the specific purpose of deepening the canals from end to end and completing the lengthening of the locks of the entire system, 454 miles in all, of which 307 miles was subsequently put under contract, but not until the entire work had been estimated, in the light of the surveys of 1896, to cost $16,000,000. The estimated cost of the portions contracted for, about two-thirds of the whole, will aggregate $7,121,000, and be completed in the coming year; the estimated cost of the remaining third is thus nearly $9,000,000, or as much as the entire work was to have cost. Of course all must be completed before any part can be utilized for larger boats.

In accounting for this condition of affairs the State Engineer makes some amazing statements, not always consistent, by way of explanation. In one place he says "the Legislature fixed the amount which the people were to be asked to ratify at a figure . . . $2,573,000 less than the engineer's estimate"; in another "It has been sorely disappointing to those charged with the responsibility of this great work that it has been found impossible to confine its cost to the limits of the first appropriation, and a further statement of the efforts that have been made in that direction and the reason why they have proved futile is but just to all concerned." In this brief article it will be impossible to follow through this statement, but so far as he speaks as an engineer his plea may be fairly summarized as follows:

"1. That no surveys for such an improvement of the canals as is now under way had ever been made up to 1896.

"2. That the estimated cost of this improvement, as submitted to the Constitutional Convention in 1894, was prepared in 12 days, and was, therefore, well known and stated to be practically mere guess-work.

"3. That the careful surveys and estimates made in 1896, from a thorough examination of the 454 miles of canals to be improved, showed that the probable cost of such improvement was about $16,000,000.

"4. That an unsuccessful effort was then made to cut down the work to bring the cost within the appropriated $9,000,000.

"5. That the impossibility of using a large portion of the excavated material for use on the banks of the canals, as originally contemplated, very greatly increased the cost.

"6. That during the progress of the work of excavation the unpreventable caving in of dilapidated and toppling walls and structures necessitated new construction and increased quantities at large additional expense."

He also adds that the work is being thoroughly, honestly and very cheaply done by the contractors and therefore it cannot be said that the State is being robbed. As to this the charge has been publicly made that such is not the fact and that the state will be put to a large additional expense to repair the damage to the canal caused by the way in which the contractors have done their work.

But there was, it appears, an "Executive Committee," so called, representing the following commercial associations of the state:

Chamber of Commerce, state of New York; New York Board of Trade and Transportation; Maritime Association Port of New York; North Side Board of Trade of the City of New York; Canal Boat Owners' and Commercial Association; Union for Improvement of the Canals; Manufacturers' Association Kings and Queens Counties; Buffalo Merchants' Exchange; Oswego Board of Trade; Rochester Chamber of Commerce; Syracuse Business Men's Association; Lockport Business Men's Association; Whitehall Board of Trade; Port Henry Board of Trade; Citizens' Association of Troy.

This committee consisted of 24 members, from 10 cities, all business men, presumably, who knew all about canals. One of the committee tells a very different story about the implied "understanding" of the inadequacy of the appropriation. He says, as quoted in the *Journal of Commerce*, that the committee, at the time of advocating the $9,000,000 appropriation, had no information before it that suggested any doubt of the sufficiency of that sum, and that the basis upon which the committee reached its estimate of $9,000,000 was the known average cost of each previous lengthening of locks; and as to deepening, there was the careful estimate made by a former State Engineer, in 1878, for increasing the depth of water one foot on the Erie and Oswego canals. These figures were practically the only guides he had in fixing upon the sum that should be asked for from the state, and if to add one foot in depth would cost the sum which had been estimated in 1878 it "seemed that to add 2 ft. would cost about double that" and thus was easily built up an "estimate" amounting to $4,150,000. This he thought liberal, but some other members of the committee, none of whom were engineers, by the way, suggested $10,000,000 "as a round figure," and so he voted in the committee for $9,000,000, feeling that it was too large, but safer to have enough than to ask for too little, although "it allowed nearly five million dollars for contingencies and for building vertical walls, where, in the discretion of the State Engineer and the Superintendent, the substitution was necessary." He thinks the commercial bodies and the committee are not to blame for the mistakes, for "we had good data to figure on and asked for what we thought would be enough." Still, in spite of all, he thinks that the seven millions additional to the nine millions now contemplated "would be a very reasonable sum to pay to finish the improvement, but he should want to know that the engineers had not made another mistake before asking for so much money." The reader can pick out for himself the incongruities in the above statement. Probably the utter absurdity and futility of their action will not appear to the members of the committee, and, it is to be feared, not even to the public; but it is a port in the storm for the State Engineer, for it makes it pretty clear that, at least, it was not his estimate that misled the committee, although that will not excuse him for his part.

With every desire to be just and to make due allowance for the difficulties in the way of a political engineer's technical success, as affairs are now administered in New York state, it must be said that the excuses for this lamentable outcome suggest a considerable lack of feeling of responsibility to the people of the state. Were the engineer but the paid servant of others, who were responsible, his plea that he could not estimate correctly for lack of data might pass muster an an acceptable, even if lame, excuse; but he was, and is, the State Engineer, elected by the people and sworn to serve them through his supposed special knowledge and attainments. By his own showing he allowed his responsibility to be overshadowed by the Legislature, and now he seeks to hide it among the imaginary unusual difficulties of what really is in its elements a perfectly plain and simple piece of work.

"Old walls," he says, "have from old age and poor original construction slipped into the canal at many places, because the excavation at the center was carried to a depth lower than the foundation of the old wall." Of course, what else was to have been expected and allowed for, as the result of undermining walls built 70 years ago and designed for a shallow depth? He enumerates other difficult features which he designates as "unforeseen or supposedly avoidable . . . expenses not foreseen when the contracts were made," etc.

The most important cause of the increase of cost over the original estimate, according to the engineer, was the discovery that the material excavated from the canal bottom would not answer for raising the embankments, borrowed material being requisite. This, he says, entailed a double quantity of excavation, and if this feature could have been foreseen and the cost added to the original estimate it would alone have been sufficient to cover all the other discrepancies and would have brought the total of the preliminary estimate up to $16,000,000, the amount now known to be required. But we are not told why such an obvious and important point was not determined at the start, although the experience of the canal authorities on this very point had been accumulating for half a century or more.

Apparently, little dependence can be placed even on the revised estimates, in view of such oversights. It would seem wise to refer the whole matter to independent engineers for a thorough investigation before it is assumed that the work can be completed for the sum of $16,000,000, and whether it will even be worth while for the people of the state to continue it on the lines laid down.

Fair and Reasonable Discussion of the Pooling Bill.

The thing most needed in the controversy concerning the proposed legalization of pooling, says the (New York) *Journal of Commerce*, is "a little more frankness and moderation on both sides; the railroads and the Commission are hopelessly at odds." Mr. Prouty, spokesman for the Interstate Commerce Commission, in his *Forum* article, claims that pools, once allowed, would be sure death to competition, an assumption which, says the *Journal*, is nonsense: "combine as they may the railroads must adjust their charges between the great shipping points of this country to the commercial competition of the world, no less than to the rates established by the competition of canal, lake and river transportation." On the other hand, railroad managers fail to perceive that this fact removes the force of their objections to the control over rates demanded by the Interstate Commerce Commission; and in general they exaggerate the evils of Commission control.

The railroads do seem to be very greatly alarmed over what may be largely an imaginary danger; but individual railroad officers who have spoken are perfectly reasonable, and the great majority may agree with them for anything that we can discover. Mr. Milton H. Smith, President of the Louisville & Nashville, is very clear. It is rumored at Washington that some important roads do not want a law permitting pooling; but Mr. Smith's road can get along without such a law as well, perhaps, as any, and his view is expressed in these words:

> I do not object to the enactment of a law authorizing carriers to divide traffic and do not object to contracts that may be made between carriers, should such an act be passed, being subject to the supervision and approval of the Interstate Commerce Commission, or that the rates received for the transportation of traffic so divided be subject to such supervision and approval, so long as pooling, or dividing traffic, is not obligatory. I do object to the enactment of a law devolving upon the Commission authority over rates of transportation of [all] the carriers of the United States [on all traffic].

This last objection is one of those which Mr. Prouty would wish to have put in different phrase, and it illustrates how the railroads and the Commission are supposed to be at odds. The Commissioners say that a tribunal such as theirs should have power to correct rates *that are complained of;* meaning, apparently, an infinitesimal percentage of the rates of the country. But can they fairly assume that complaints would be no more numerous than they have been in the past? Railroad men assume that a great mass of rates would be complained of; so great a mass, indeed, that the Commission would find itself dealing, in fact, if not in name, with just as large a proportion of the business of the country as if it undertook to prescribe all rates, as do the Commissions of Texas and Georgia; and who can say that this assumption is unfounded?

Traffic managers know from long experience how numerous and persistent are applicants for reductions everywhere, and what large numbers of such claims are made regardless of economic reason. If claims *should* prove to be numerous, and the Commission had the powers of a court, it would probably be admitted, even by the Commissioners, that the political and territorial elements that enter into the composition of the Commission must make it hard to be just. This would be, indeed, a fatal drawback, and the advocates of control ought to admit that the power to alter one rate is the power to alter all rates.

The *Journal of Commerce* thinks that the existence of all the well-known competitive forces of commerce would have such an influence over rates that the railroads need not fear to let the Commission regulate them; but could we hope or expect that the Commission would have the wisdom and the courage to adjust rates to the actual necessities of trade? Has any board of five commissioners, or any ten boards, ever commanded such wisdom and courage since our government first undertook to regulate trade? It may be answered that railroad men themselves do not adjust rates fairly; that sometimes the farmers shipping to Galveston get the best rates and at other times those sending through Duluth are the most favored; that rates are not always reduced just at the right time (and unfortunately, as is the case at Chicago now, they are not always advanced when they ought to be advanced); but we have at least the assurance that we are following in well-beaten commercial paths and are not trying a vast experiment in Government bureau management. Railroad managers, dealing with a limited territory and having the powerful stimulant of self-interest, can at least make changes quickly, when quickness is needed. "The delays of the law" have greatly detracted from the value of the work of the Commission and, we presume, from the value of some of its decisions. The people, in allowing railroads to make their own rates, avoid the delays of formal legal proceedings—which delays are inseparable from any regulation of one party's business by another—and, perhaps, sacrifice some advantage that legal procedure might afford; but with the enormous gain of having rates fitted to present facts.

The *Journal of Commerce* says it is hard to find out just what the great body of shippers want; and it commends the action of the National Board of Trade, whose resolutions we printed last week. Possibly the importance of this body may be overrated. It seems to be composed of delegates not very closely affiliated with the interests which they ostensibly represent; and it is always to be remembered that the philosophy of the influence of pooling on rates is obscure and is not much studied by merchants. The action of the Washington meeting does indeed show that Eastern boards of trade, or such of their members as attend meetings, are in favor of a pooling law, and that Western boards are opposed to one. But there are shippers in the East who are in favor of perpetuating a law which enables them to get secret reductions, and there are many in the West who are not opposed to pooling.

The needs of shippers, if not their wishes, can be more readily learned by an appeal to simple experience. The great body of shippers, both East and West, will testify that publicity and stability—and stability insures publicity—are the chief needs at present. We do not say the only need; no one asks for rigid rates, and pooling does not preclude the reduction of rates where reductions are needed. It is a matter of common knowledge that the greatest opposers of pooling are the few large shippers who now profit by secret reductions; the Grangers, whose reasoning is ignorant or selfish or both, and the politicians. There can be little doubt what the great body of shippers would want if they made themselves heard.

"Doubt as to the precise form and extent of control over pools that shall be given to the Commission" is another difficulty in the way. But the Foraker bill has been approved, we believe, by every railroad officer who has publicly spoken on the subject. That gives the Commission the fullest possible power. If the railroads accept the bill, and the Commissioners have power to absolutely suspend its operation at any time on 30 days' notice, practically without giving their reasons, who can complain? If, in addition, the Commissioners ask the power to revise rates, the demand is nothing better than a Congressional log-roll; you go for my bill and I'll go for yours.

The Foraker bill, introduced in the Senate March 30 last, provides, in substance, that pools shall be lawful 20 days after being filed with the Interstate Commerce Commission, unless the Commission, after investigation, shall disapprove; and such disapproval shall be based on the *opinion* of the Commission that the operation of the pool would result in unreasonable rates, etc. After notice and hearing the Commission shall, if it see fit, issue an order to change rates, etc., or it may order the dissolution of the pool on 30 days' notice; and such order shall make the pool unlawful thenceforth. The order is reviewable by the Circuit Court, which must give speedy hearing and proceed according to Section 16 as nearly as may be. Appeal may be taken from the Circuit Court to the Supreme Court within 30 days, but during the pendency of the matter before either of these courts the pool continues unlawful.

The sufficiency of the Foraker bill, with answers to some of the claims made by Commissioner Prouty in the *Forum*, are the subject of an argument in the Louisville *Courier-Journal* of Dec. 21, by Mr. W. D. Hines, one of the Attorneys of the Louisville & Nashville.* Mr. Hines sums up as follows:

1. The contention that an unlimited power in the Commission to fix rates and to put all its orders into force without reference to the courts is necessary as a protection against the suggested evils of pooling, and that the provisions of the Foraker bill do not afford ample protection in that regard is a most shadowy pretense, at once dispelled when the subject is considered.
2. In view of the remarkable decrease of freight rates in the last quarter of a century and their present condition, it will not for a moment be suggested that rates in general are too high even by the smallest fraction. The unlimited power desired by the Commission to fix all interstate rates in the country is not necessary, therefore, even according to its views of the propriety of governmental regulation, to correct rates generally in this country.
3. If, while rates generally are low enough, there may be any improper adjustments of rates between different localities, the present law gives the Commission ample power to correct such troubles, as has been fully recognized by the very courts which have denied to the Commission the unwarranted powers it has in later years assumed to exercise.
4. In regard to that most crying evil of the railroad situation, secret rebates and other discriminations in favor of particular individuals, the power desired by the Commission will not and can not add one iota to the efficacy of the law.
5. The powers now ambitiously reached out after by Mr. Prouty and his four associates are, in effect, powers to control the commercial fortunes of every section of the country, while at present each section can rely upon its own railroads to make, as a matter of self-protection, rates calculated to develop that section; they are powers so extensive as to make it physically impossible for the Commission to exercise them intelligently or properly, even if the Commission could be relied on at all times to display the absolute impartiality necessary toward all sections of the country; they are powers of the most far-reaching character, legislative, judical and executive; in a practical way they would be in most cases absolutely conclusive, and they are powers utterly out of harmony with the whole spirit of our institutions; to confer them would be a most dangerous experiment, and an experiment for which there is not the slightest necessity or excuse.

The Bond Market for 1897.

The transactions in all kinds of bonds in 1897 exceeded in volume any previous years. In state and railroad bonds alone the aggregate on the New York Stock Exchange was $529,343,000. In 1896 the aggregate was $358,815,850. The largest previous record was $501,398,200 in 1892. The aggregate of government bonds sold in 1897 was $10,134,030, which compares with $27,121,550 in 1896. The large returns of 1896 were due to transactions arising from the Treasury issues.

The heaviest month's business was in August, when the total for railroad bonds was $74,631,050. The next largest was September, the total being $67,297,800. The smallest returns were $22,227,300, in April; the third in point of size was $61,287,450, in December. These figures and dates serve to outline the course of the year's market. In April, when the demand was the lightest, prices were the lowest. Likewise the activity of August and September was attended by practically the highest prices. From the maximum figures prices reacted moderately in the last quarter of the year, and at the close had a recovery more or less general, which in many important instances advanced prices to the highest figures of the year.

Among the causes of the better market we may mention a revival of confidence coupled with difficulty in finding profitable and safe investments; the comparatively substantial yields offered especially early in the year; a big crop, and, for the first time in a decade, an opportunity for the farmer to sell at the high prices guaranteeing a heavy Western as well as Eastern movement of traffic; and the success attending the refunding of the Lake Shore bonds on a 3½ per cent. basis. This became known in February, and was really the start in the advance in stocks and bonds that developed in the summer and early fall.

Wall Street at that time was not a stranger to a 3½ per cent. bond at par, but the instances were rare; among them a certain minor issue of the Pennsylvania Railroad and one of the Illinois Central. However, in these cases insiders and not the public made the market for the securities; a demand for $50,000,000 3½ per cent. bonds at par or thereabouts was indeed a novelty. It can be said to have opened a new chapter in railroad financeering, and to have caused a material modification of the views of capitalists regarding interest returns. This has been demonstrated by a reduction in the savings bank rate of interest in important instances this fall from 4 to 3½ per cent. The success of subsequent low rate issues of different prominent railroads, of which the Rock Island is the latest example, indicated the tendency of capital and exercised a very powerful influence in advancing values of railroad securities generally.

This ability of the railroads to float a four per cent. refunding issue will, in the next seven years, reduce fixed charges by approximately 16¾ million dollars. Could the refunding bonds bear a uniform rate of 3½ per cent. the saving would be 20¼ million dollars. The *Financial Chronicle*, from whose columns this estimate is taken, judges that from 1897 to 1905, both inclusive, $710,689,262 in bonds, bearing five per cent. or more interest, will mature.

There is a tendency among railroad managements which have bonds to retire in the near future to provide an issue not only large enough to take up all the out-

* Since this editorial was written we have received from Mr. Aldace F. Walker a pamphlet on Federal legislation as affecting railroad transportation, extracts from which are given on another page.—EDITOR.

standing indebtedness, but to provide for requirements many years ahead. This has been known in the past to result in dropsical securities.

The *Railroad Gazette* has prepared an elaborate table of bonds with a view to showing the year's movement. It does not include all bonds listed on the New York Stock Exchange, but all securities selected are representative. In the classification made no beaten path has been followed, but each security placed in the group most nearly representative of its character. The high of the year, the low, the last price and the net change of each bond are given. Advances are marked by plus signs and declines by minus signs. Each group is averaged.

The greatest gains were made by the Southwestern issues. This is due largely to the speculative character of many of those bonds, and particularly to the sharp improvement of the Atchison issues, following a satisfactory reorganization. Next in appreciation stand the Grangers. A gain of over 5½ per cent. reflected a demand based upon good crops and heavy traffic. The Transcontinentals holds fourth place. Northern Pacific securities played a very prominent part in making this average high. The most substantial gains of the year, and those in all likelihood which will be maintained, were recorded by the Trunk lines. Like the improvement in governments, it was over two per cent. Perhaps this movement in governments more correctly reflects the confidence of capital than any other market department. A feature of governments was comparatively heavy selling by foreign holders, with hardly a reaction in price here. The only group which recorded a decline which was due to general conditions was that of soft coal. This industry has been on a hard-pan basis throughout the year. Soft coal roads are among the very few which are not highly prosperous. The heavy losses in Columbus & Hocking Valley bonds was in a large measure responsible for the adverse average of the group.

In the table following will be found the average changes of the different groups in the year.

Groups.	Change.
Eastern	— 1.25
Granger	+ 5.57
Southwestern	+ 8.03
Transcontinental	+ 4.78
Trunk lines	+ 2.01
Southern	+ 2.30
Western	+ 2.18
Coal, anthracite	+ 2.48
Coal, soft	— 1.70
Miscellaneous	+ 0.875
Street railways	+ 3.07
Governments	+ 2.86

The tables of prices are appended. Limits of space prevent a treatment of specific causes affecting the values of different securities:

THE COURSE OF THE BOND MARKET IN '897.

Railroads.	High.	Low.	Last.	Net change.
Eastern:				
Long Island 1st 7's	106¾	101½	101½	—2¼
" " con. 5's	119	113	117	—2
" " gen. 4's	91	76½	84	—5
N. Y., Bklyn & Man. Beach 1st 5's	107½	102½	107½	- 5
N. Y., N. H. & H. cn. db. cf.	144½	132½	141½	+8
Average decline, 1.25.				
Granger:				
Bur., Ced. Rpds. & N. 5's	109½	105	106⅝	+1⅝
Chic. & Mil. 1st 7's	106	103	103	—1½
C., B. & Q. conv. 5's	110⅞	99¼	110¾	+10¼
" con. 7's	120½	115	118⅞	+1⅛
" s. f. 5's	107	103	103¾	+¾
" deb. 5's	107	93	106	+8⅝
" Den. div. 4's, 1922	101¼	93	101¼	+7¼
" Neb. ext. 4's	98⅜	87¼	98⅜	+10⅝
Chic., Bur. & North. 1st 5's	110	103½	110	+6⅞
Des Moines & Ft. D. 1st 2½	70	62½	70	+5
Iowa Central 1st 5's	100¼	88	99	+8
Mil. & North. 1sts, 1913	122	118	122	+6
M., L. S. & W. ext. & imp. s. f. 5's	118	112	117	+5
Minn. & St. Louis con. 5's	107¼	100	106⅜	+1⅝
" 1st 7's	143	137½	143	+2¾
Northwest con. 7's	147	140	145	+5
" gold 7's coup	121¼	115¼	116¾	+¼
" gold 7's reg	119½	115½	116	
" s. f. 5's	112⅝	108¾	111¾	—1¼
" s. f. 6's	120	114	116	+2
" deb. 5's, 1909	110⅛	106	109⅝	+1⅜
" deb. 5's, 1921	116	111¾	115	+10
" deb. 5's, 1933	117¾	110⅝	117	+6
" ext. 4's	106	101	105⅞	+5⅝
Rock Island coup. 1sts	134⅛	129½	131⅜	+3⅛
" " reg. 1sts	133	128	132¾	+2¼
" " ext. & col. 5's	108	101⅞	107⅝	+3
" " ext. & col. 5's reg	107⅝	101½	104⅞	+3⅞
" " deb 5's	106¾	98	106¾	+12¾
St. Paul & Omaha cn. 6's	133½	128	133⅞	+7½
" & Duluth 2d 5's	107¾	102	107¾	+4¾
" cn. 7's	142	128	142	+10
" 1st gold 7's	141	126	141	+12¾
" 2d 7's 3-10s	141¾	128	140	+13
" 1st 8's	108½	102	103½	
" term. 5's	115⅜	111½	115	+3
" Has. & Dak. 7's	135	126	135	+7½
" I. & D. div. 7's	142¼	128	142¼	+14¾
" Mineral Point 5's	111	107	111	+6½
" gen. 4's, Series A	106	96	106	+8¼
Wabash deb., Series B	33½	18½	27	+6
" 1st 5's	108¼	101⅜	107¾	+1¾
" 2d 5's	81⅛	63½	80¾	—10¾
Average advance, 5.57.				
Southwestern:				
Atch., Top. & S. F. gen. 4's	90¼	78⅝	89⅝	+10⅝
" " adj. 4's	61	41¾	58⅜	+15⅛
Int. & Gt. Northern 1st 6's	124	117	121	+4
" " 2ds	86½	78	85	+11
" " 3as	48	25½	44	+21
Iron Mount. gen. con. 5's st'mpd	87	68	85	
Iron Mount. gen. con. 5's	90⅝	67½	88½	+14½
Kansas Pac. con. 6's, tr. ctfs.	103	67	85	+19
" " 6's, 1895	115¼	108	115¼	+8¼
" " " 1896	115¼	111½	114	+4
" " D. div. 6's	120½	113½	1.8¾	+8¾
Missouri Pac. con. 6's	98½	68	94	+2
" " 3d 7's	110	98	107	+4
" " col. tr. 5's	71½	40	66⅛	+21¼
St. Louis & San F. 2d 6's, A	115	112	114½	+2½
" " " " B	116¼	112	114½	+2½
" " " " C	115⅝	111¾	114½	+2½
" " gen. 5's	105¼	94½	105⅞	
St. Louis & San F. gen. 6's	110⅝	108½	110⅜	
" " tr. 5's	95	86	95	—1⅛
" " 4's	77	62½	71½	
Texas Pacific 1st 5's	98	85¾	97⅜	+11⅞
" " 2d 5's	33½	18	28⅝	+8⅝
Average advance, 8.03.				
Transcontinental:				
North. Pac. 1st 6's	122½	113	118½	+2⅜
" " " reg	122	113⅜	119	+1
" " term. 6's	110	97¾	106	—1¾
" " 3's	61⅜	51½	61	+8¾
" " 4's	96	85½	96	+10⅛
South. Pac. of Ariz. 1st 6's	105	90	104⅝	+9⅝
" " Cal. 1st 6's	109	105⅛	109	+2½
" " con. 5's	94	85	93¼	+7¾
Un. Pac. 6's of 1896	104¾	101	103	
" " " 1897	104¾	101	103	
" " " 1898	105	101⅛	102¾	
" " " 1899	105½	101⅞	103⅛	
" " s. f. 8's t. ctf	121	87	114	+26½
" " col. tr. 5's	83	72	83	+8
" " " 6's	103	97	102	+2
" " Den. & G. con. 5's tr. ctfs	53⅞	33	49	
Average advance, 4.78.				
Trunk Lines:				
B. & O. 5's 1925 ctfs	91	73	73	
" " " " 1885-1925	94	76½	78	—12
" " Parkb'g Br. 6's	112¼	105¼	109⅝	+5½
Canada South 1st 5's	113½	168	112¼	+1⅜
" 2d 5's	109	104½	108¼	+8
Chic. & Erie 1st	112	108¾	112	+2
C. C. C. & St. L., Cairo Div. 4's	99⅝	89	90⅛	—2½
C. C. C. & St. L. col. tr. 4's	96½	90	96	+3¼
Erie 1st con. 7's	145⅛	139¼	145½	+6½
" ext. 5's	122	116	122	+6
" 3d " 4½'s	116	112	112⅝	+3⅝
" 4th " 5's	120⅛	118¼	120½	+6
" 5th " 4's	105⅜	103¾	105¾	+1½
" gen. lien 3-4's	73¾	62	71½	+6½
Mich. Cent. con. 5's-1902	108	105½	106	—2
" 5's-1931	127½	120	127½	+9⅛
N. Y. C. & H. R. 1st coup. 7's	121¾	117½	119½	—1½
N. Y. C. & H. R. reg. 7's	120¾	117	119	—2½
" " " " deb. 5's	112	106	110½	—5½
" " " " " 4's	105⅝	102½	103¼	—¾
" " " " ext. 4's	105	101⅞	103	+1¾
Lake Shore con. 1st. 7's	111¼	109⅝	111⅝	
Lake Shore reg. 1st 7's	118½	108	109¾	
" cn. 2d 7's	121¼	119	119	
" rez. 2d 7s	121⅛	118⅛	119	
" div. 7's	111	104¼	105¾	
Penn. Ry. 4½'s	115¾	109¾	115¼	+1½
P., C., C. & St. L. 1st con. 7's	111¼	109½	111¼	
P., C., C. & St. L. 4½ series A	112	106⅞	111⅝	+1⅜
P., C., C. & St. L. 4½ series B	111⅝	108¼	111⅜	+2⅝
Pitts. & West. 4's	80	66	79	—4½
Rome, Wat. & Ogd. 1st con.	122½	117¾	122½	+6⅝
West Shore 4's, coupon	111⅞	1'5	111	+4
" 4 s, reg	111⅝	104	109	+5
Average advance, 2.01.				
Southern:				
Atl. & Danv. 1st 5's	97¼	90½	97¼	
Cent. Georgia con. 5's	95	86½	91½	+1⅜
" 1st 5's	118¾	112¼	118¾	
" 1st income	52	38	44	
" 2d "	18¾	8½	15½	
" 3d "	10	5	8⅜	
Cent. R. R. of Georgia col. 5's	96½	90	91½	—3½
East Tenn., Va. & Ga. 1st 7's	111	107¼	111	—2
East Tenn., Va. & Ga. re-lien 4-5's	92½	86	92½	+2⅝
East Tenn., Va. & Ga. div. 5's	116	112	116	+5
East Tenn., Va. & Ga. con. 5's	112	107	110½	+3½
Ill. Cent. 4's, 1951	118	110	118	+8
" 4's, 1952	101¼	101½	103½	+3½
" 4's, 1953	103	99½	101½	+1¾
L. & N. gen. 6's	119	115⅝	117	+1
" con. 7's	106⅛	101	102¼	—2¾
" unified 4's	87½	78¼	87⅜	+7⅜
" col. tr. 5's	103	98½	101½	+½
Mobile & Ohio new 6's	124	116¾	120½	
" 1st ext. 6's	119	112	119	+2
" gen. 4's	78¼	65	77	
Ohio & Miss. con. 7's	105⅝	102	103	+2
" " con. 2d 7's	121	115	121	+10
Rich. & Danv. con. 6's	124¾	117¾	124¼	+3¾
" " deb. 5's sta	101	95	100	+7
Virginia Mid. gen. 5's	104½	100	103½	+1½
" " " " sta.	103½	99½	102¾	+3¼
South Ry. con. 5's	95	87½	95	+5½
Average advance, 2.30.				
Western:				
Cent. Pac. 6's 1898	104¼	100	102⅝	—1¼
" " San Joaq. 6's	104½	101	101¼	—¾
" " land grant 5's	101	96½	100½	+2½
Col. Midland gen. 6's ctfs	67¾	59	65	—3⅝
Den. & Rio. Gr. 4's	91⅞	87¼	91¼	+½
" " " imp. 5's	87¼	80	85½	+½
Ore. Imp. 1st 6's	108	88	102½	+5
" " con. 5's	*49	15	*45½	
Ore. Ry & Nav. s. f. 6's	116¾	110	115¼	+2½
" " " con. 4's	94¼	80	93⅜	+10⅜
Oregon Short Line 6's	124	113⅛	123¾	+10¾
" " con. 5's	99¾	86	98¾	
Average advance, 2.18.				
Coal (Hard):				
Del. & Hud. Pa. div. 7's	147½	142	147½	+4
Del., Lack. & W. 7's	128	125½	128	
Lehigh Valley term. 5's	112	106	111½	+1¼
" & Wilkesb. con. as'd. 7's	104½	90	106¼	+1⅝
Lehigh & Wilkesb. con. as'd. 5's	90	76½	90	
Morris & Essex con. guar. 7's	145½	140	142	+5
" " 1st 7's	145	140½	143	+3½
" " " " 1871	114¼	111¾	112	
N. J. Central gen. 5's	118	106	112¾	—5¼
" " " " reg	117¼	105	110	—4½
" " con. 1899	108¼	104⅝	105¾	+⅛
N. Y., Ont. & West con. 5's	111	107	107¾	—¾
" " " ref. 4's	99	88¾	97½	+5¼
" Sus. " 1st ref. 5's	107	100	106	+ ¾
" " " gen. 5's	90½	68	86⅝	+19⅝
" " " 2d 4½'s	85	73	85	+11¾
" " " term. 5's	109¼	105	109¼	+7½
Rdg. gen'l 4's	86⅝	80¼	85⅞	+4
Rens. & Sar. 1st coupon	148⅞	140	148¾	+¾
Wilkes-Barre & East 1st 5's	98	87½	93	—9
Average advance, 2.48.				
Coal (soft):				
Buff., Roch. & Pitts. 5's	105	95½	105	+8½
Ches. & Ohio gen. 4½'s	85¼	72	83¼	+9½
" " con. 5's	114½	107¾	114½	+6⅛
" " series A	121¾	116½	119¼	+1½
Col. & Hock Val. con. 5's	88¾	63	75¼	—8¼
" " " gen. 6's	87	49½	52	—30½
Col. Coal & Iron con. 6's	110	92	92	—6
Lake Erie & West. 1st 5's	118	1.8½	118	+½
" " " 2d 5's	104	89½	104	+1¾
Norfolk & West. gen. 6's	123¾	117	123¾	+4¾
" con. 4's	80⅛	67½	78⅞	
Ohio South. 4's	18	9	14	—3
" 1st 6's	90	80	80	—5
Tenn. Coal & Iron B. div. con. 6's	91	79	87	—1
Tenn. Coal & Iron T. div. 6's	89½	79	81	—4
Wheeling & Lake Erie 5's	93	85	92½	—1⅛
Wheeling & Lake Erie, Wheel. div. 5's	90	70	81	
Average decline, 1.70.				
Miscellaneous Railroads:				
Ann Arbor 4's	84½	74½	83½	+9½
C. & East. Ill. 1st con. 6's	133	121	133	+9½
" gen. 5's	103	98⅞	101	+1
Chic. & W. Ind. gen. 6 s	120	116	119½	+2¼
Clev., Lor. & W. con. 5's	103	98	103	
" & Canton 1st 5's ctfs.	74	67	71	—4
Dul., S. S. & Atl. 5's	106½	99½	106¼	+3¾
Evans. & T. H. con. 6's	114½	108	114	+5¾
" gen. 5's	76	70½	76	
Flint, P. & Marq. 6's	116	110¾	113¾	+¾
Mex. Int. 1st 4's	73	69	69	—2¼
Peo., Dec. & E. 1st 6's	104	92	103¼	+3¼
" 2d 5's	27½	10	14½	—12
Wis. Central 5's	38⅞	31⅞	34	—3¼
" incomes	7½	4⅝	6	—1⅜
Average advance, .875.				
Street Railways:				
B'way & 7th Ave. con. 5's	120¾	116½	120⅛	+3⅝
Bklyn. Elev. 1st tr. co. ctfs.	86¼	70	83	—4¼
" Rapid Transit 5's	96¼	70	94	+16¼
Kings Co. Elev. 1st 5's	60½	44	60½	+11½
Fulton Elev. 1st 5's	49	36	49	
Man. Ry. Con. 4's	97¾	91½	94	—1½
Met. Elev. 1st 6's	121½	116⅜	121⅛	+1⅞
" 2d 6's	107¾	102¼	104	+1½
Met. St. Ry. gen. 5's	113½	109¾	113⅛	
Third Ave. Ry. 1st 5's	124½	120	124⅛	+1⅛
Average advance, 3.07.				
Governments:				
U. S. reg. 2's	98½	98¼	98¼	+2¾
" 4's reg. of 1907	113¼	110⅜	112¾	+3¾
" " coup. of 1907	115	111⅝	115	+4¾
" " reg. of 1925	129	120⅛	129	+8⅝
" " coup. of 1925	129½	120⅜	127⅞	+7⅞
" 5 s reg. of 1904	115	113	114	+½
" " coup. of 1904	115⅞	113	114½	+½
" currency 6's of 1898	103½	99¾	99¾	
" " " " 1899	107¾	106½	107¾	
Average advance, 2.86.				

* All assessments paid.

The Ketcham Case.

We gave last week a statement of some of the points in the Ketcham suit, wherein a Chicago jury gave against the Chicago & Northwestern the preposterous verdict of $21,666 for alleged blacklisting. In dealing with this subject we have given such reports as we found in the newspapers (so far as they seemed to be somewhere within range of the truth), because we were unsuccessful in getting anything from an impartial source. At last, however, we have got a statement from an officer of the Chicago & Northwestern, and the reader can now clear up some of the inexplicable features that beclouded the case as it appeared in the newspaper reports. This statement, in substance, is as follows:

The article in the *Outlook* was written by a young attorney for Ketcham. In view of its omissions it is anything but a temperate statement. No evidence was presented during the trial showing that Ketcham had been refused employment by any railroad other than the Chicago Great Western. At the time of the strike in 1894 Ketcham left the Chicago & Northwestern, where he was employed as a conductor, and joined the strikers; he was one of Eugene V. Debs's assistants and had charge of the American Railway Union men on the Chicago & Northwestern. Before the strike was declared off Ketcham went to the Chicago Great Western and obtained employment as a conductor, without any investigation. Between the time he left the Chicago & Northwestern and the time he went to the Chicago Great Western he went among the Chicago & Northwestern men and urged them to strike, saying that Debs would soon be running the road. This was brought out repeatedly during the trial.

Ketcham secured employment on the Chicago Great Western and made one round trip as a conductor and came back to Chicago. He then stayed away for some days, sending word that he was sick. The trainmaster found evidence that this was false, and when Ketcham finally reported told him that he would not have such a liar and discharged him. Ketcham then went to his former division superintendent on the Chicago & Northwestern and obtained a copy of his record which stated the facts and showed that he left voluntarily during the A. R. U. strike. Ketcham put this in his pocket and never showed it to any one. He was never refused employment, but went to work for one of the elevated roads in Chicago and afterward worked for the city of Chicago, and was at work until within one week of the last trial (November, 1897). He was never discharged by anybody except the Chicago Great Western.

Within one week from the time he was discharged by the Chicago Great Western, Ketcham brought suit against the Chicago & Northwestern and John C. Stuart, division superintendent, substantially for libel, because of the statements made in the copy of his record before referred to. Before the suit came to trial, the action was changed and conspiracy was charged. In this trial the jury disagreed, 10 being in favor of the defendant. A new suit was brought on virtually the same charge which resulted in the verdict against the Chicago & Northwestern.

Norman Ford, the witness referred to, was an office boy for the Illinois Central. He swore he mailed a copy of a list to each General Manager or General Superintendent in Chicago, but could give the name of only one man to whom a list was sent. This man, with every other such officer in Chicago, swore he had never received or seen such a list. The list was one of a series issued monthly by the Illinois Central, and sent to the heads of the several departments. Every other employee in the Illinois Central office, six of them, contradicted Ford flatly and the Illinois Central officers swore the list had not been sent to other roads. Ford carried off a mimeograph copy of the list, and after being discharged for impertinence, after working about one month he tried to get the Illinois Central to buy the list from him.

The story about the fireman is absolutely false. A switchman (not a fireman) was subpœnaed by the plain-

tiff, but no fees were paid. He came and told his Superintendent he had been subpœnaed and said he did not want to testify, and was told that he need not until his fees were paid. His testimony was merely to identify a letter and was not important. The charge of the judge to the jury was virtually to acquit the defendant, and the verdict, greatly at variance with the charge, was a surprise to the attorneys. The case has not been appealed, but is held under advisement, on motion for new trial, by Judge Clifford, and all papers are in the hands of the court. There was no legal testimony of any sort introduced during the Ketcham trial tending to prove the existence of a general blacklist among the railroad companies, though this claim was the foundation of the case.

Mr. J. F. Tucker, Chairman of the Central Freight Association, has issued a circular asking traffic officers to do what they can (inviting the co-operation of Boards of Trade) to secure the modification of the Federal Law of 1880, under which imported merchandise is transported in bond from the seaboard to interior cities. Under this law, as now administered, cars must be loaded under the supervision of a government officer; must be sealed by him, and the loading must be finished before sundown; and the seal must not be broken until the car reaches destination. As this makes it impracticable to send freight for two or more cities in the ame car, railroads find it necessary to decline to carry goods in bond, except to the seven large cities in the Central States, though there are 87 cities in the country to which goods may be thus carried. The change which it is proposed to ask Congress to make is the abolition of all government participation in the work of transportation, the bond given by the railroad company being, it is declared, a sufficient safeguard against losses. The bond of the carrier being sufficient for the protection of the government, he should be permitted to handle this freight precisely as he does all other freight. This project was described by Mr. M. Townsend, of the Pennsylvania, in a paper reported in the *Railroad Gazette* of June 18, 1897.

President Callaway, of the Lake Shore & Michigan Southern, was lately reported as saying that the long-distance telephone is now used so much by business men that railroad passenger traffic is suffering a material loss in the journeys which these business men would have to make if they did not have the telephone. The reporters of the daily papers quickly took up this statement and inquired of other railroad men to see whether they could get it confirmed; but they found no evidence whatever. It appears that Mr. Depew had previously made a similar statement, and the reporters went to him, but he interprets 'long distance" as applied to telephones to distances of 20 to 50 miles, and he supports his statement by the claim that merchants within that distance of large cities send their orders for merchandise by telephone daily instead of making a visit weekly or semi-weekly. Inquiries among the merchants, however, fail to confirm the view of Mr. Depew; and traffic officers of railroads whose passenger business has increased during the past year scout the idea of hurtful telephone competition.

It appears that in the state of Iowa the law requiring automatic couplers on freight cars went into effect on the first of January, and that there is no condition or exception; every road is now liable to penalty if it is disobeyed and the railroad commissioners have no discretion in the matter. According to press dispatches a similar condition exists in Nebraska. It is said that the Chicago, St. Paul, Minneapolis & Omaha and the Fremont, Elkhorn & Missouri Valley are obeying the laws carefully, with the result that their traffic departments are embarrassed, and some Nebraska and Iowa shippers inconvenienced in not being able to get cars. It seems that the Iowa law, as originally passed, gave the railroad commissioners the right to extend the time for equipping cars with safety appliances until Jan. 1, 1900, but in the new code this provision is omitted, either from neglect or design, on the part of the codifiers of the statutes.

Chicago's River Trade.

Few people realize the importance of Chicago as a marine port, and the volume of traffic which passes through the Chicago River. Only two ports in the world outrank Chicago in tonnage handled, these ports being London and New York, as is shown by the following statistics from the United States Treasury Department, which give the details of tonnage for the last fiscal year:

City.	Tonnage.	City.	Tonnage
New York	15,333,398	Havre	4,562,692
London	14,433,580	Bremen	4,325,487
Chicago	12.965,832	Hull	3,933,123
Hamburg	12.447,706	Puget Sound Ports	3,654,929
Liverpool	10,489,578	San Francisco	3,528,291
Cardiff	10,478,394	Boston	3,403,682
Antwerp	10,083,228	Philadelphia	3,173,031
Tyne ports	8,665,115	Baltimore	2,727,486
Marseilles	7,374,591	New Orleans	2,230,692

In clearances Chicago is far ahead of New York, as is shown by these figures of total entrances and clearances: Chicago, 18,687; New York, 13,962; Boston, 6,262; Baltimore, 4,493. Of the 18,687 vessels passing in and out of Chicago last year, 15,000 entered the Chicago River, the rest going to the Calumet, where facilities for handling large cargoes are better than those in the river in its present condition.

Demands of commerce have led to the building of vessels so big that some of them can hardly pass the bridge draws, in spite of which there has been a gain each year in the number of clearances and the volume of tonnage, this increase having been placed at 32.7 per cent. annually for the last 10 years.

The traffic going out is chiefly grain, most of the big elevators being located along the river, and the shipments from them by lake in 1896 amounting to 116,952,258 bu. Coal and lumber form the principal receipts, entries last year amounting to 1,360,300 tons of coal and 940,116,000 ft. of lumber. One grocery firm does a lake business of from $6,000,000 to $8,000,000 a year, and several concerns in other lines make shipments averaging $5,000,000 annually. These facts induce opposition to any plan which contemplates the closing of the Chicago River by permanent bridges. Rivermen are willing to have something done to still further lessen the delays incident to bridge traffic, and plans prepared by City Bridge Engineer Riter, under direction of the City Council, provide for the demolition of the bridges now in use at Rush, State, Dearborn, Clark and Wells streets, and the construction of bascule bridges to replace them, which would involve an expenditure of $705,000. Two plans for doing this work have been suggested. One is to issue long-time bonds, and with the funds thus obtained make the changes as rapidly as possible; the other to make use of such appropriations as the Council will pass from time to time, and to confine the changes to two or three bridges each year.

There are 58 bridges on the main river and its branches, representing an original outlay of $3,135,909, and aggregating 2.81 miles in length. The cost of the bridges ranges from $237,189 for the Halstead street lift bridge, to $1,500, the average for the large ones such as the Madison street bridge, being $110,000.

Dredging the river is the work of the government, and while efforts will at first be made to secure a depth of 21 ft. only, provision will be made for a subsequent excavation to 26 ft. below datum, and the City Bridge Engineer in his estimates has arranged for foundations to the maximum depth. The expenditures by the government for river and harbor improvements at Chicago in the last 20 years have been small when compared with amounts expended for other cities, as is shown by the following table:

City.	Expenditure.	City.	Expenditure.
New York	$10,000,000	Philadelphia	$2,439,000
Galveston	6,379 625	New Orleans	1,515,815
Savannah	4,718,861	Chicago	1,247,399
Charleston	3,759,543	Boston	1,173,250

—Condensed from the Chicago Tribune.

TECHNICAL.

Manufacturing and Business.

The Vice-President of the Joseph Dixon Crucible Co. writes: "The Dixon Company has shared in the general prosperity. The year has been an agreeable one, the future looks rosy to those who have eyes to see. Perhaps the outlook was never more inviting. Never were there so many roads open to wealth to those who know how to find them."

The New Year announcement of the Falls Hollow Staybolt Company, of Cuyahoga Falls, O., is that the cost of production has been so materially lessened as to justify largely reduced prices for 1898. Safety hollow bolts, guaranteed of the finest charcoal iron, are quoted at 6¼ cents, and solid bolts at 3¾ cents per pound. The Falls company believe that they have now worked the price down to where no master mechanics will doubt the economy of using the hollow bolts exclusively.

Louis J. Cox, Robert S. Cox and John S. Cox have acquired entire control of the Terre Haute Car & Mfg. Co., of Terre Haute, Ind. The business will be continued as heretofore.

L. R. Lemoine, of Philadelphia, has been made Vice-President and General Manager of the McNeal Pipe & Foundry Co., of Burlington, N. J. Mr. Lemoine was for a long time with R. D. Wood & Co., of Philadelphia.

A. G. Richardson has resigned as General Sales Agent for the Ewald Iron Co., of St. Louis, Mo., to engage in other business. Mr. Richardson has held the position of General Sales Agent for the past eight years.

The large plant of the F. C. Austin Mfg. Co., at Carroll avenue and Carpenter street, Chicago, was badly damaged by fire on the evening of December 29. This company is one of the largest makers of contractors' implements and heavy farm machinery in the West. It is estimated the damage will amount to between $80,000 and $100,000, while the plant was insured for $90.000.

The Guaquil & Quito Railway Co. is in the market for ties for the extension of its 65 miles of road. It prefers to contract for delivery of pine or cedar ties at a North Pacific port—Washington or Oregon. Address of the Secretary is E. Morley, 31 Broad street, New York.

New Stations and Shops.

The Chicago, Milwaukee & St. Paul has enlarged the freight car erecting shop at West Milwaukee from 104 ft. ×400 ft. to 104 ft. ×625 ft. This addition to the length of the shop is the only change in buildings that has been made, and this was done in order that the plant may turn out 15 new freight cars, 36 or 37 ft. long, per day. Three new wood-working tools and two iron-working tools have been added, and the shop will be completed and the tools in place, so that the work of building 15 cars a day will commence about Jan. 10.

The Canadian Pacific has awarded a contract to Thomas Tompkins, of Brockville, Ont., for building a new station at Vancouver, B. C.

The Goodwin Dump Car.

The Goodwin Car Co. has recently been giving exhibitions of dumping different kinds of material from its all-steel gravity dump car—operated by compressed air—to the Great Northern, Illinois Central and Pennsylvania railroads, at Chicago, Minneapolis and St. Paul. The exhibitions in the Northwest were given in below zero weather, and the materials used were all frozen, having been thoroughly wet with water from a hose and allowed to stand 12 hours before dumping. In St. Paul, for the Great Northern road, loads of ashes were dumped while running at 16 miles an hour, and the ashes and cinder were evenly distributed at the sides of the track free from the rails. Photographs of these exhibitions were made, and can be had from the Goodwin Car Co. The Illinois Central made special tests of the center-dumping qualities of the cars for ballasting purposes. These tests were made in Chicago, near the main offices of the company. The tests for the Pennsylvania were made in Indiana, a special train for officials, and others directly interested in the tests, being run from Chicago. The material dumped was damp sand, dug from a bank, which, with the mercury below zero, partially froze while being loaded. The tests with this material were dumping all on one side, part on each side, and also through the center for ballasting, all of which were successful.

Some of the Goodwin cars are now working at Sandy Hook, filling from the government trestle, dumping rocks weighing several tons, and throwing them clear of the trestle. One man operates the cars on the trestle, and as a few seconds only suffice for discharging the load the unloading is accomplished in the time taken in shifting the locomotive for the return trip.

Axle Lighting on the Santa Fe.

Twenty-eight cars on the Atchison, Topeka & Sant Fe are now equipped for axle lighting by the system of the National Electric Car Lighting Co. They run on the principal trains from Chicago to Kansas City, Denver, El Paso, Los Angeles and Galveston. Several dining cars have been equipped, and wired for electric fans in addition to the light. The composite cars running on the California Limited are also equipped, and Mr. Ripley's private car is being fitted with the axle light, as is that of Mr. Nevin, General Manager of the Santa Fe Pacific. Progress has been somewhat delayed by the heavy passenger business, which has kept the cars pretty well in service.

Mexican Drainage Canal.

The work on the Mexico City drainage canal is now finished. Pearson & Sons have discharged 3,000 men and only a few men remain doing up the odds and ends. It is probable that the government will soon take over the canal from the contractors, and it is also possible that the first water will be turned into the canal at San Lazaro in a very short time. This great undertaking including the tunnel, has cost up to date ove $21,000,000

Air Brake Litigation.

A suit has been brought by the Westinghouse Air Brake Co. against the Buffalo, Rochester & Pittsburgh Railroad for using an infringing air-brake apparatus made by the New York Air Brake Co. On motion for a preliminary injunction argued before Judge Coxe at Utica, N. Y., Jan. 4, the injunction was granted and the railroad company was allowed four months in which to remove the infringing brakes, to the amount of about one thousand, from its cars.

THE SCRAP HEAP.

Notes.

The Cleveland, Cincinnati, Chicago & St. Louis now requires all firemen, rear brakemen, yard foremen and switchmen to have regulation watches, the same as conductors and enginemen.

The Western Union Telegraph Company has made arrangements to connect its wires with those of Mexico at Nogales, Juarez and Laredo, and has made contract with the Mexican government for the transaction of through business.

The Railroad Commissioners of North Carolina have ordered that the reports of the railroad companies, made to the Board quarterly, must show freight and passenger earnings separately, and also operating expenses; and that a separate report must be made for each division and branch.

The directors of the Illinois Central have passed a formal resolution thanking the officers and employees of the company in the Southern states for their devotion to duty during the recent visitation of yellow fever, and copies of the resolution are posted in all the stations throughout the company's lines. Employees in Memphis and New Orleans are especially commended.

President A. E. Stillwell, of the Kansas City, Pittsburgh & Gulf, has built a tank car for carrying oysters in sea water, and will run it from Port Arthur, La., to Kansas City, Mo. The whole body of the car is taken up with the tanks, the design being somewhat like that of a coal car. The sides are of white pine, 3 in. thick, and the tank is divided into four compartments, the whole having a capacity of 8,200 gals.

The formal order of the New York State Railroad Commissioners, extending the time in which the car coupler law must be complied with, includes all railroad companies under the jurisdiction of the State. This order applies only to the coupler law; the law concerning automatic brakes does not require all cars to be equipped

until Jan. 1, 1903, three years later than the time now fixed for complying with the coupler law.

Press dispatches of Dec. 30 report great damage by floods in the state of Washington, especially in the valleys of the Chehalis, Newaukum and Skagit rivers. The Northern Pacific bridge over the Newaukum was floated off its foundations. Washouts were numerous on the South Bend Branch, and the Gray's Harbor Branch. A number of bridges were destroyed on the line of the Great Northern east of Sutton.

At Brentwood, Ga., lately, an old freight car, used as a freight "depot," was burned up in the night, and the storekeeper of the town at once put in a claim of $3.300 for merchandise destroyed in the fire; but it was suspected that he had taken out the goods before the fire was set, and the railroad company's detective had the ashes analyzed by a chemist; and the analysis is said to have shown that substances like those charged for in the claim could not have been in the fire.

On the evening of Jan. 4, about 7 o'clock, the express car on a passenger train of the Kansas City, Pittsburgh & Gulf was robbed within five minutes after it started out of Kansas City. The robbers boarded the train at the station and succeeded in getting into the car before the messenger discovered them. The way safe was open and they took what valuables were in sight, without attempting to open the through safe. They jumped off and escaped when the train approached the Chicago & Alton crossing.

Mr. Daniels will soon go to Washington to again present to the Congressional Committee the arguments in favor of the passage of the bill to suppress ticket brokerage. This bill has lately been endorsed by the Iowa Wholesale Grocers' Association, the Merchants' Association of Chicago and the Utica (N. Y.) Chamber of Commerce. Resolutions opposing it have been passed by the Illinois Commercial Men's Association and the President of the Commercial Travelers' National League says that he is going to Washington to oppose it.

It appears that Governor Russell, of North Carolina, failed, after all, to install his new appointees, Messrs. Caldwell and Pearson, in the railroad commissioners' office in place of Messrs. Wilson, though the Supreme Court decided that his action in removing the commissioners was legal. Immediately after the decision, counsel for the Wilsons secured from the Chief Justice, who had dissented from the opinion of the court, a writ of error and supersedeas, which will carry the case to the United States Supreme Court and leave the Wilsons n possession of the office.

A Chicago paper says that the industrial department of the Illinois Central has, during the past year, secured the establishment of 23 new factories along the line of the road, mostly south of the Ohio River. The total amount of capital invested was $1.665,000, and the factories give employment to 2,067 persons. During the past few months the Industrial Commissioner, Mr. G. C. Power, has received a large number of inquiries from persons seeking to establish manufactories of hardwood. Hardwood timber is so much cheaper in the South that there is considerable inducement to move there, from the Northern states, factories using that material.

The Coal Trade in 1897.

The *Coal Trade Journal* in its review of the trade during the year 1897 gives the total production of anthracite as 41,404,809 tons, about two millions less than in 1896, and about five millions less than in 1895. The output for December, included in this total, is estimated at 3,500,000 tons. The agreement between the different producers as to the percentage of the total to be marketed by each company has been pretty well adhered to now for 23 months; but nevertheless the estimated tonnage is kept constantly in advance of the demand, so that prices continue dull. In the first half of 1897 all the companies were quite harmonious in keeping the product within the demand, but since then the old story of over production has been repeated.

The movement of soft coal to the seaboard has been utterly demoralized, sales of first-class coal being made at New England ports at prices only a trifle above those charged at the shipping ports in 1896, and it is said that the contracts at these low figures run for two years or more. The tonnage continues large; Beech Creek is ahead and Pocahontas next; Clearfield and Chesapeake & Ohio maintain their records of the previous year, and the Georges Creek District shows a good increase. There was a strike in the principal soft coal districts in July and August, which produced little change in prices and no great loss in tonnage, the average number of days' working time, in the year, being not much different from that in years when there were no strikes. The receipts of anthracite coal at Lake Superior ports have amounted to 500,000 tons, which is about the same as in 1896; and of bituminous coal 1,200,000 tons, a little less than in 1896.

There has been a considerable development in coal mining in Michigan during 1897, and this is likely to take away some trade from Ohio mines.

Mineral Production for the Year.

The *Engineering and Mining Journal* has published its usual table showing the quantities and values of minerals produced in the United States in the year 1897, with comparisons with 1896. From this table we copy the following items:

		1897.	1896.
Coal, anthracite	tons of 2,000 lbs.	49,537,675	48,855,563
" bituminous	" " "	144,901,331	137,516 631
Coke	" " "	11,774,273	10,359,584
Iron ore	" 2,240 "	17,856,000	14,650,000
Iron, pig	" " "	9,491,976	8 623 127
Petroleum	bbls. of 42 gals.	63,100,000	61,396,394
Aluminum	lbs.	4,000 000	1,300,000
Copper	"	475,338 340	467,822.973
Copper sulphate	"	46,652,000	48,372,840
Gold	Troy ounces.	2,685,000	2,558,433
Silver	" "	56,117,000	58,488,810

Tennessee Railroad Taxes.

The Governor of Tennessee has called an extra session of the Legislature, to meet on Jan. 17. The principal business will be the consideration of a modification of the law relating to the assessment and taxation of railroads and telegraphs The recently appointed Railroad Commission increased the valuation of railroad property in 1897 to $70,000,000, about 30 millions over the assessment for 1896. This assessment was approved by the Board of Equalizers, but the railroad companies secured from the Federal Court a temporary injunction and the state officers now seem to be fearful that they will not be able to carry out their plan of largely increasing the taxes of the railroads. The companies claimed that the assessment was illegal, as that for the previous year was still in force; that the act creating the Railroad Commission was unconstitutional; and that assessments were excessive and unjust. On the first count alone Judge Clark granted a temporary injunction. Affidavits were made showing that railroad property was assessed for its full value, while real estate, in spite of the law, was assessed at an average of only three-fourths of its value. The state's Attorney General says that the state's sovereign right to tax is involved. If the principle that a federal court could go behind the assessments made by the constituted Board of Assessors was accepted, one of the inherent rights of government would be taken away. He had no doubt the Supreme Court of the United States would uphold the state. Indiana, he said, had raised the assessment of one railroad from $8,000,000 to $22,000,000. The state showed that a fair profit was paid on this valuation, and the Supreme Court held the assessment valid.

Failure of a Steel Tired Car-Wheel.

The Railroad Commissioners of Maine have issued a report on the derailment near Etna on September 5 when a passenger train waa derailed by the failure of a wheel, and one passenger was killed. The report says: "It was an Allen steel tired wheel, and the accident was caused by the tire becoming loose and slipping off the center. The bolts which held the retaining rims were all broken, and the tire had come entirely off the wheel, which was on the forward end of the rear truck-frame. From our examination of the wheel, we are satisfied hat the tire had been loose for some months. The bolts ad evidently been worn in the retaining rim by the lipping of the tire upon the center, showing that the njury to to the wheel was not a new one.

"We are satisfied that the construction of the wheel was faulty, that there was a defect in it when it left the shops where it was manufactured. We feel that there was also negligence on the part of the inspectors at the stations on the Maine Central Railroad, where the wheel should have been inspected. . . ." The nature of the defect in manufacture is not stated in the report, and the Commissioners do not say in what particular the inspectors might or should have done more to discover that the tire was loose.

New Locomotives on the Eastern of France.

The Eastern Railroad of France has recently put in service a new type of locomotive, designed for branch lines with a broken profile. They have six drivers coupled, of 1.51 meters diameter, and a bogie truck. This truck is of the design used by the Company since the Exposition of 1889. The boiler has a large heating surface and is provided with 96 Serve tubes. The firebox is placed between the two rear axles, has a firebrick arch and the grate is desgned for very small coal. These locomotives weigh 60 tons in working order and carry 45 tons on the drivers.

Trade With China.

In 1895 what is known as the Lyons Commission went to China to study the commercial and industrial condition of that country, with a view to increasing the business between China and France. The commission consisted of 13 members, each representing a prominent French chamber of commerce. It remained in China two years, the last member returning Oct. 5, 1897. The commission says the people are adroit, industrious and love money, but do not know how to make it. The mandarins are discontented, and are openly or sullenly hostile. They are the principal beneficiaries of the present régime. As a consequence, the influential, lettered classes cannot be expected to aid Europeans to introduce business and a new régime into China. The commission says: "We will succeed on two conditions, to wit, export men to China at the same time we export goods; be as far-sighted and as patient as the importance of such a work requires, bearing in mind that it must move slowly in its accomplishment in the extreme Orient." The absence of transportation is the great obstacle to business, but even a greater hindrance is the lack of credit. The constantly growing foreign debt will soon force China to reform its financial policy, which can only be done by outside help. The nation that establishes trade throughout China, builds railroads and introduces improved methods of water transportation will probably reform the finances and monopolize much of the trade.

LOCOMOTIVE BUILDING.

The Seaboard Air Line is in the market for seven new locomotives.

The Illinois Central has bought three locomotives which the Rogers Locomotive Works had in stock.

The Washington County Railroad, now being built from Bangor to Calais, Me., 120 miles, will require eight new locomotives within a short time.

The Long Island Railroad has placed the order for the five passenger locomotives, referred to in our issue of Dec. 3, with the Brooks Locomotive Works, of Dunkirk, N. Y.

The Boston & Maine Railroad has increased its order with the Schenectady Locomotive Works from 8 to 10 ten-wheel compound engines. They will have 21 and 32 × 26-in. cylinders.

The Baldwin Locomotive Works are building four compound consolidation engines for the Mexican National, five 10-wheel freight and one American passenger engine for the Charleston & Western Carolina and three 10-wheel engines for the El Paso & Northeastern.

The Canadian Pacific has placed orders for 30 compound consolidation locomotives, 15 with the Baldwin Locomotive Works and a like number with the Richmond Locomotive & Machine Works. The former will be of the Vauclain type with 14 and 24 × 24-in cylinders, 56-in. driving wheels and weigh in working order 140,000 lbs., with 125,000 lbs. on the drivers. The boiler will be 64 in. in diameter, firebox 108 in. long by 42 in. wide, driving journals 8½ × 10 in., and tender capacity 3,800 gals.

CAR BUILDING.

It is reported that the Mobile & Ohio is in the market for 500 coal and 500 box cars.

The Lake Shore & Michigan Southern has asked for bids on 500 box, 250 coal and 250 ore cars.

The Cudahy Packing Co. has ordered 200 refrigerator cars from the Illinois Car & Equipment Co.

C. W. Goyer & Co., of Memphis, Tenn., wish to correspond with parties who have tank cars for lease.

The Schuylkill Electric Railway Co., of Pottsville, Pa., will probably need four new open cars before June 1.

John Morrell & Co., of Ottumwa, Ia., are not in the market for refrigerator cars as stated by a contemporary.

Two hundred freight cars are being built at the Fort Wayne shops of the Pennsylvania Lines West of Pittsburgh.

The Missouri Car & Foundry Co. is reported to have received an order for 40 coal and 20 box cars of 60,000 lbs. capacity for the El Paso & Northeastern.

The Washington County Railroad, referred to in the locomotive building column, will require in the near future four combination, four baggage, eight passenger and 200 freight cars.

In our last issue, in reporting the order of Armour & Co., for refrigerator fruit cars, we gave the number as 10,000. This should have read 1,000. It is, as stated, the largest refrigerator car order ever placed.

The Chicago, Milwaukee & St. Paul has placed an order with the Terre Haute Car & Mfg. Co. for 500 box cars. They will be 34 ft. long, of 60,000 lbs. capacity and equipped with Westinghouse air-brakes, Janney couplers and Chicago grain doors. No other special equipments will be used. The cars are for July and August delivery.

The Jackson & Sharp Co., of Wilmington, Del., has recently finished building two electric cars for the Bennington & Hoosac Falls electric railroad, one for the Gloucester, Essex & Beverly electric line, of Gloucester, Mass., and seven for the Syracuse & Suburban railroad of Syracuse, N. Y. The company has also ready for shipment one freight car for the last named road.

The Cudahy Co. has placed an order with the Illinois Car & Equipment Co. for 200 refrigerator and 10 tank cars. The order for refrigerator cars will probably be increased to 250. They will be 36 ft. 8 in. over end sills, 8 ft. 10 in. over side sills and equipped with Miner's draft rigging, Westinghouse air brakes, automatic couplers and either Simplex or American steel bolsters.

The Baltimore & Ohio order for the cars referred to in our issue of Dec. 24, 1897, is believed to have been placed as follows: 2,000 with the Michigan-Peninsular Car Co., 500 with the Missouri Car & Foundry Co. and 3,000 box with Pullman's Palace Car Co. The Baltimore & Ohio Southwestern order for 1,000 cars is said to have been for 250 coal cars with the Ohio Falls Car Mfg. Co. and 750 box cars with Pullman's Palace Car Co.

The Cincinnati, Hamilton & Dayton, as stated in our last issue, has placed orders for 1 000 new box cars for the Indiana, Decatur & Western Railroad, 500 with the Barney & Smith Car Co. and an equal number with the Michigan-Peninsular Car Co. They will be 36 ft. long inside in the clear, of 60,000 lbs. capacity and equipped with Westinghouse brakes, Chicago roofs, Sterlingworth-Marden brakebeams, American couplers and Detroit springs.

BRIDGE BUILDING.

Akron, O.—S. W. Parshall, City Engineer, it is reported, is having plans prepared for a viaduct on Mill street.

Birmingham, Pa.—The contract for building the bridge over the Juniata River has been awarded as follows: substructure, M. H. Stebbins, Tioga County, $3,760; superstructure, Penn Bridge Co., Beaver Falls, $5,740.

Chicago, Ill.—Petitioners are urging the Drainage Board to build bridges over the Chicago River from Twelfth street to the lake, and the following citizens have been appointed a committee to confer with the Drainage Board: S. F. Gunderson, F. S. Baird, F. E. Coyne, L. P. Friestedt and L. S. Shepard.

Cincinnati, O.—It is reported that a steel viaduct will be built at Queen City avenue, to cost probably $200,000, and that a bill has been introduced in the legislature to authorize the work.

Frank S. Krug, County Engineer, has submitted specifications for building two bridges over Eight-Mile Creek.

Fairview, S. Dak.—A bridge will be built by the County Commissioners of Lincoln County over the Big Sioux River at Groth Ford.

Frederick, Md.—It is reported that a new iron bridge will be built across the Monocacy, at Stulls Ford, at a cost of $12,000.

Green Bay, Wis.—The Council has under consideration the matter of erecting a bridge over East River, at Webster avenue.

Hartford, Conn.—Bids are asked until Jan. 12 for building a masonry bridge over the Park River at Park street. C. H. Bunce, City Surveyor.

Houston, Tex.—It is reported that a 100-ft. steel bridge will be built across Franklin street.

Hyattsville, Md.—It is reported that a bridge will be built over the Anacosta Branch at this place.

Kansas City, Mo.—The Kansas City, Pittsburgh & Gulf Railroad will build a steel bridge, 200 ft. long, over Poteau River.

Lowell, Mass.—It is reported that the contract for building the plate girder bridge was let to Frank R. Long, of 320 Broadway, New York. The price is said to be $5,612.

Missoula, Mont.—The County Commissioners are asking for bids to build approaches to the Bonner street bridge.

The Commissioners have been instructed to prepare plans for a bridge over Lynch Creek. W. B. Faucett, County Surveyor.

New Brighton, Pa.—It is reported that the Overgrade Bridge Co., chartered two years ago to build a bridge between this place and Beaver Falls, has bought the old Brighton bridge, and will now build its new structure on the site of the old one. The Overgrade Company it is understood is backed by Geo. B. Hill & Co., of Pittsbugh. The new bridge is a part of the traction company scheme by which New Castle and Pittsburgh are to be connected.

New York.—Messrs. O'Brien, Sheehan & McBean have received the contract for the bridge over the New York & Harlem River Railroad at 153d street. Contract price, $147,643.

The contract for building the bridge over the Harlem River from 145th street to 149th street has been awarded to Messrs. O'Brien, Sheehan & McBean, 258 Broadway, New York.

The contract for building a bridge and drawspan between Pelham Bay Park and City Island was awarded to Messrs. Stevens & O'Rourke, 44 Broadway.

Olivet, S. Dak.—It is reported that the George E. King Bridge Co., of De Moines, Ia., has been awarded the contract to build a steel bridge over the James River.

Pittsburgh, Pa.—Director of Public Works Bigelow in his annual report asks for appropriations for the rebuilding of the following bridges: Haights Run Bridge, $110,000; Lincoln Avenue Bridge, $150,000; Point Bridge, $100,000; South Tenth street Bridge, $215,000; Forbes street Bridge, $20,000; removing the present Schenley Park Bridge to Wilmot street, $25,000.

Plattsburgh, N. Y.—It is reported that the Berlin Iron Bridge Co. of East Berlin, Conn., has received the contract for building the single span iron bridge over the Saranac River, at Kent's Falls, the cost to be about $2,600.

Portage, Wis.—The Milwaukee Bridge Works have received the contract to build a steel bridge 90 × 14 ft.

Texarkana, Ark.—Bridges will probably be built across Sulphur River and Elliott's Creek. Sidney Stewart, Engineer.

Wheatland, Ia.—The Clinton Bridge & Iron Works, Clinton, Ia., have received the contract to build a two-span bridge over the Wapsie River, to cost about $7,500.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Providence, quarterly, 2 per cent., payable Jan. 1.

Connecticut River, 5 per cent., payable Jan. 1.

Delaware, Lackawanna & Western, quarterly, 1¾ per cent., payable Jan. 20.

Detroit, Hillsdale & Southwestern, 2 per cent., payable Jan. 5.

Norwich & Worcester, quarterly, preferred, 2 per cent., payable Jan. 1.

Pittsburgh, Fort Wayne & Chicago, quarterly, regular, 1¾ per cent., payable Jan 3; special, 1¾ per cent., payable Jan. 3.

Pittsfield & North Adams, 2½ per cent., payable Jan. 1.

Portland, Saco & Portsmouth, 3 per cent., payable Jan. 15.

Southwestern (Ga.) 2½ per cent., payable Jan. 4.

Texas Central, annual, preferred, 3 per cent., payable Jan. 15.

Ware River, 3½ per cent., payable Jan. 5.

Baltimore Consolidated Railway, 2 per cent., payable Jan. 15.

Brockton (Mass.) *Street Railway*, quarterly, 1½ per cent., payable Jan 1.

Cleveland City, quarterly, ¾ per cent., payable Jan. 10.

Lowell, Lawrence & Haverhill (Mass.), 1½ per cent., payable Jan. 1.

New London (Conn.), 2½ per cent., payable Jan. 1.

New Orleans & Carrollton, quarterly, 1½ per cent., payable Jan. 20.

Norwich (Conn.) *Street*, 1 per cent., payable Jan. 1.

Wellesley & Boston, quarterly, 1½ per cent., payable Jan. 1.

Wilkes-Barre & Wyoming Valley Traction, 1 per cent., payable Jan. 22.

Stockholders' Meetings.

Meetings of the stockholders of railway companies will be held as follows:

Allentown Railroad Company, annual, election of officers and Directors, Philadelphia, Jan. 10.

Boston & Lowell, annual, Boston, Jan. 5.

Choctaw, Oklahoma & Gulf Railroad, annual, 12 o'clock noon, at 420 Walnut street, Philadelphia, Jan. 10.

Indiana, Illinois & Iowa, annual election of Directors, Chicago, Jan. 19.

Philadelphia, Wilmington & Baltimore, annual, Wilmington, Del., Jan. 10.

Reading & Columbia, annual, election of officers, Philadelphia, Jan. 10.

Coney Island & Brooklyn, special, voting on proposition to increase capital stock, Brooklyn, Jan. 20.

West End (Boston), Directors, election of officers, Boston, Jan. 10.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Civil Engineers* meets at the House of the Society, 220 West Fifty-seventh street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds its formal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Chicago Electrical Association* meets at Room 7137 Monadnock Building, Chicago, on the first and third Fridays of each month, at 8 p. m. J. R. Cravath, Secretary.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September.

The *Denver Society of Civil Engineers* meets at 3 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Engineers' Club of Columbus*, (O.), meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m., except during July and August.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Engineers' Society of Western Pennsylvania* meets at 410 Penn avenue, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The *Locomotive Foreman's Club* meets every second Tuesday in the clubroom of the Correspondence School of Locomotive Engineers and Firemen, 335 Dearborn street, Chicago.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7:30 p. m.

The *New England Railroad Club* meets at Pierce Hall, Copley Square, Boston, Mass., on the second Tuesday of each month.

The *New York Railroad Club* meets at 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *North-West Railway Club* meets on the first Tuesday after the second Monday in each month, at 8 p. m., the place of meeting alternating between the West Hotel, Minneapolis, and the Ryan Hotel, St. Paul.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *St. Louis Railway Club* holds its regular meeting on the second Friday of each month, at 3 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the second Thursday in January, April, August and November.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. A. Sorge, Jr., 1533 Marquette Building, Chicago, is secretary.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *Western Society of Engineers* meets in its rooms on the first Wednesday of each month, at 8 p. m., to hear reports, and for the reading and discussion of papers. The headquarters of the Society are at 1736–1739 Monadnock Block, Chicago.

Saratoga Conventions.

The Grand Union Hotel at Saratoga Springs, N. Y., announces that it will open at its regular time of opening, June 15, and that it will accommodate members of the M. C. B. and M. M. conventions at $4 a day for rooms without bath and $5 a day for rooms with bath.

The Railway Signaling Club.

On Tuesday, Jan. 11, the Railway Signaling Club will visit the new interlocking plant at the State Line crossing, near Hammond, Ind. This plant was quite fully illustrated in the *Railroad Gazette*, Dec. 17. A special train over the Chicago & Western Indiana will leave the Dearborn street station, Chicago, at 2 p. m. and will return in time for dinner at the Technical Club. In the evening the annual meeting of the Signaling Club will be held.

The Civil Engineers' Club of Cleveland.

A special meeting was held in Case Library, Dec. 28. The paper of the evening, on "Construction of Ships for Service on the Great Lakes," was read by Richard L. Newman, Active Member. The paper was illustrated by numerous drawings and charts, and treated of the methods by which modern ships are given greater strength in cross-section without increasing the weight or depth, thus permitting the design of vessels of much greater length and tonnage than were thought possible a few years ago. The proper location of the machinery as affecting the strength of the hull was considered.

The Engineers' Club of Philadelphia.

A stated meeting of the Club was held on Saturday, January 1, 1898, at 8 o'clock p. m. No paper was arranged for.

A special business meeting of the Club will be held on Saturday, Jan. 8, at 8 o'clock p. m. The tellers will announce the result of the election of members, and the paper will be on "The Keely Motor," by Mr. E. A. Scott.

The following are the nominations for officers for 1898:

President, Edgar Marburg.
President, L. Y. Schermerhorn.
Vice-President, Wm. C. L. Eglin.
Secretary, L. F. Rondinella.
Treasurer, Geo. T. Gwilliam.
Director, Wm. Copeland Furber.
Director, Richard L. Humphrey.
Director, C. H. Ott.
Director, Edwin F. Smith.

A stated meeting was held Dec. 18, 1897, Vice-President Carl Hering in the chair. Sixty-five members and visitors present. A topical question on "A Better House for the Engineers' Club of Philadelphia" was opened by the presentation of the following report by the Committee on New Building. The Committee offered a resolution as follows: "That the report of the Committee be referred to the Board of Directors, with instructions to ascertain what amount of subscription of second mortgage bonds could be obtained, and what proportion of the resident membership would agree to a raising of the dues to $20 per year in the event of the purchase of a new club-house, to investigate the availability and cost of buildings, and to consider the question of renting a club house in another location." This resolution was carried.

Southern and Southwestern Railway Club.

The Club held its quarterly meeting at Atlanta, Ga., Nov. 11 last. President W. H. Thomas in the chair.

The report of the committee on "Trains Parting" was postponed and the committee continued and given more time.

The report of the committee on "Exhaust Pipes" was also ordered carried over to the next meeting, but a few letters bearing on the subject were read and blueprints examined from Mr. J. G. Tomlinson, S. M. P., Queen & Crescent. Mr. Tomlinson wrote that he had "a 55-ton engine, 19 in. × 24 in. cylinders, fitted with exhaust pipes and stack and draft appliances, exactly in accordance with the recommendations made by the M. M. committee. The engine is a perfect steamer, the front end is cleared entirely of sparks, and I am inclined to think that with a nozzle and an exhaust pipe of increased area the fuel consumption will be materially reduced."

A discussion followed on the topical question, "Should the M. C. B. code repair prices for material be varied according to territories?" The motion was put and carried to refer the matter to the committee appointed on the revision of the rules and instruct them to look up the advisability of changing the present repair prices on material and consider how they should be varied according to different territories, this committee to report its views to the Arbitration Committee of the M. C. B. Association. The following were appointed a committee: J. M. Holt, E. M. Roberts and S. A. Sexton.

A discussion then followed on the question, "Wherein should the present M. C. B. code amounts for labor be changed, if at all?" On motion this matter was also referred to the same committee on rules with the suggestion from the Secretary that a report be made at the next meeting.

The annual election of officers took place and the present incumbents were re-elected unanimously. The officers are: W. H. Thomas, President; W. H. Hudson, First Vice President; John S. Cook, Second Vice-President; Robert H. Libby, Treasurer; S. A. Charpiot, Secretary.

On motion, the Executive Committee was directed to make arrangements for a banquet at the January meeting, which takes place Thursday, Jan. 13. The following subjects will be discussed at that meeting: "Trains Parting"; special committee, W. H. Owens, O. B. Bidwell, J. B. Michael. "Exhaust Pipes"; committee, C. F. Thomas, F. H. McGee, H. A. Gillis, George D. Harris and J. G. Tomlinson. "Revision of M. C. B. Rules"; committee, J. M. Holt, E. M. Roberts and S. A. Sexton.

St. Louis Railway Club.

The meeting of Dec. 10 was held at the Southern Hotel, President Besler in the chair. A communication was received from Mr. H. W. Gays, General Manager of the C. P. & St. L. R. R., as follows: "Would like a little information on a subject that, no doubt, some one of the members can give. Why is there a variation in the journal load carried by trucks? A 4¼ × 8-in. journal with standard truck would have car body marked:

Refrigerator—Weight, 34,000; capacity, 60,000; load and car, 94,000. Box—Weight, 24,000; capacity, 6,000; load and car, 84,000. Coal—Weight, 20,000; capacity, 60,000; load and car, 80,000. Flat—Weight, 18,000; capacity, 60,000; load and car, 78,000. Body truss the same in each class.

Should not the weight of car and load govern? If so, is there not a great waste of "capacity" on everything less than refrigerator? A committee of three was appointed to report at the next meeting, being Messrs. F. W. Brazier, of the Illinois Central; Thomas Eubanks, of the Missouri Pacific, and A. G. Steinbrenner, of the A. R. T. Co.

A paper was read by Mr. Frank Rearden, Superintendent of Motive Power of the Missouri Pacific, and past President of the Club, on "Railroad Clubs."

A topical discussion was had on "Locomotives; the Best Types for Given Services" and also on "The Compound Locomotive." Other discussions were on passenger and freight equipment, the possible further improvement being taken up.

The topics for discussion at the January meeting are from the paper submitted by Geo. B. Leighton, President, Los Angeles Terminal R. R., entitled "English Railway Practice," viz:

1. Could we in this country have made the progress which has been made if the same methods and restrictions for railroad construction as practiced in England had here obtained? Give your reasons for justification of our methods and would the same be applicable in England?
2. Should the government undertake to regulate the construction of railroads?
3. What saving can be effected in maintenance and operation by following the English practices in permanent way as compared with American?
4. Is the track water tank available for the average American practice?
5. Are there any railroads in this country using locomotives on which the engineman sits on left-hand side of the cab?
6. What advantage on double track is claimed for each practice, using left-hand vs. right-hand track?
7. Should station passenger platform be raised to height of car sills and thus do away with steps?
8. Why do American practices in block signaling differ from English? Name the points of advantage in each.
9. Freight stations. English vs. American practice. Describe the operation of Cupples Station, St. Louis.
10. Store door receipt and delivery, are we coming to it?
11. Cab service in connection with passenger department.
12. Railroad hotels.
13. The Staff system vs. the American Train Dispatcher.
14. The English practice of inspectos who report directly to the General Manager. Has it place in this country?
15. The English Clearing House. Can we to advantage introduce a similar institution in the United States?

The Committee of Arrangements appointed to prepare papers for future meetings announce the following:

January Meeting.—An address by Col. S. W. Fordyce, President St. Louis Southwestern Railway, and a paper, by J. A. Carney, Master Mechanic C., B. & Q. R. R., Beardstown, Ill., entitled "Shop Etchings."

February Meeting.—Paper entitled "The Performance of a Four-Cylinder Locomotive," by Prof. R. A. Smart, of Purdue University, Lafayette, Ind., and a paper by Geo. E. Howard, Superintendent Railroad Department Scarritt-Comstock Furniture Co., St. Louis, entitled "The Supply Man and What He Has Done to Improve the Railway Service."

March Meeting.—Paper entitled "The Claim Agent, His Relations to Various Departments of a Railroad," by S. D. Webster, General Claim Agent Terminal R. R. Association, St. Louis.

April Meeting.—Paper by Chas. Wanghop, Joint Car Inspector, East St. Louis, Ill., entitled "Car Inspection Past, Present and Future."

PERSONAL.

—Capt. J. W. Dickerson, heretofore Southern Division Superintendent of the Gulf, Colorado & Santa Fe, at Temple, Tex, has resigned. Effective Jan. 1.

—Mr. David P. Kimball, one of the three Directors appointed by the Governor of Massachusetts for the Fitchburg, has resigned. He will be succeeded by Hon. J. R. Leeson.

—Mr. J. H. Green, heretofore Superintendent of Motive Power and Machinery of the South Carolina & Georgia, with headquarters at Charleston, S. C., has resigned. Effective Jan. 1.

—Mr. William McLeod, Auditor of the Charleston & Western Carolina, with headquarters at Augusta, Ga., has resigned, to go with another company. He will be succeeded by E. W. Mills.

—Mr. John W. Dickinson, heretofore Superintendent of the Southern Division of the Gulf, Colorado & Santa Fe with headquarters at Temple, Tex., has resigned. Resignation took effect Jan. 1.

—Mr. Thomas L. Wallace, heretofore General Freight Agent for the Middle Division of the Pennsylvania, with headquarters at Harrisburg, Pa., has resigned. His resignation took effect Jan. 1.

—Mr. Bernard L. Green, of the Osborne Co., Civil Engineers, who has for the past eight months been studying engineering works and methods of construction in Europe, has recently returned to Cleveland, O.

—Mr. John McCormick, the oldest Trainmaster on the Pennsylvania, died at his home in Altoona, Pa., Dec. 29, aged 70. He was made a Trainmaster on the Pennsylvania in 1852, and was retired about a year ago.

—Mr. W. C. Cross has resigned as General Yardmaster and Trainmaster of the Chicago, Burlington & Quincy, at Burlington, Ia., to take effect Jan. 1. He has been connected with this company for nearly 21 years, the last nine as General Yardmaster, and seven as Trainmaster.

—Mr. Charles J. Owens, for about ten years Chief Goods Manager of the London & Southwestern, has been appointed General Manager of the company, taking the place of Sir Charles Scotter, who has become a member of the Board of Directors. Mr. Owens has been on the London & Southwestern since 1862.

—Mr. H. M. Beatty, Chief Locomotive Superintendent of the Cape Government Railways of South Africa, sailed from New York for Europe on the Germanic Jan. 5. Mr. Beatty left South Africa early in November of last year to study the equipment of the principal railroads of Europe and this country. He will stay in London until the last of this month.

—Mr. Charles R. DeFreest, who has been succeeded as Secretary of the New York State Railroad Commission by Mr. John S Kenyon, is to remain with the Board as Chief of the Department of Grade Crossings. This department will deal with the applications of railroad companies and towns for the abolition of grade crossings under the act of 1897. By the terms of this act the state pays a share of the cost of such changes.

—Mr. William H. Paulding, at one time a Director of the New York & Northern, now a part of the New York Central & Hudson River, died at his home in Peekskill, N. Y., Dec. 5, from paralysis of the heart, aged 64 years. At the time of his death Mr. Paulding was a Director of the New York, Ontario & Western, the American Safe Deposit Co, and the Gold Creek, Nevada, Mining Co., and President of the Pottier & Stymus Manufacturing Co., Peekskill.

—Mr. Gouverneur Morris died at his home in Detroit, Mich., Dec, 30, of heart disease. Mr. Morris was a Civil Engineer, and from 1867 to 1874 he was engaged in railroad building in various parts of the United States. Later he became interested in coal mining operations, and in 1880 made an examination for the Northern Pacific of the coal deposits of the Yellowstone Valley. Mr. Morris was a member of the American Society of Civil Engineers.

—Mr. J. C. Yager, heretofore Superintendent of the Wagner Palace Car Company, has been appointed General Manager, succeeding Mr. J. A. Spoor, resigned. W. O. Chase, heretofore Superintendent of the Western Division, with headquarters at Chicago, succeeded Mr. Yager, and Mr. C. Lincoln, District Superintendent at Chicago, has been appointed to succeed Mr. Chase as Superintendent of the Western Division. The appointments took effect Jan. 1.

—Mr. William L. Elseffer, a Civil Engineer of New York City, died Jan. 2, at the age of 71 years. Mr. Elseffer was engaged many years ago on surveys and construction of some of the lines now included in the New York Central & Hudson River Railroad and had a good deal of experience on Western railroads. Of late years he has been in practice as a consulting engineer and has been rather well-known as a promoter and as an occasional controversial writer in the newspapers.

—Mr. George S. Greene, Jr., who has been for almost 23 years Chief Engineer of the Dock Department of New York city, has been removed by the new government of that town. Whatever may be the merits of his successor, this is a public misfortune. Through all those years and through all kinds of city government Mr. Greene has pursued his way with unsullied name and with professional honor. The general public knows little of his work, so quietly has it been done; but engineers all over the world recognize the efficiency, the originality, the judgment and the wisdom with which he has planned and executed all the waterfront improvements of the great city. To-day those most competent to judge give him a place in the first rank of engineers working in his special field. The conditions which compel the city to lose the services of such a man, in the maturity of his powers, with his wealth of knowledge and experience, are barbaric; but doubtless other cities will profit by his freedom from the cares of an exacting office.

—We regret to announce the death, on Dec. 29, at Gloucester, England, of Mr. James Platt, the head of the firm of Felding & Platt, Limited, machine tool builders. Mr. Platt was a member of the Council of the Institution of Mechanical Engineers, member of the Institution of Civil Engineers, and also of the Iron and Steel Institute. He was vice-chairman of the Board of Directors of the Gloucester Railway, Carriage & Wagon Company, the largest car building establishment in England, and he had many friends on this side of the Atlantic.

James Platt was born in Manchester, England, Feb. 4, 1834. He was educated and served his apprenticeship in Sowerby Bridge, Yorkshire, where his father, Mr. John Platt, was the Engineer and Manager of the celebrated tool builders Francis Berry & Sons. When about 24 years of age he left their works and become Manager of a general engineering works in Gloucester. About this time he designed and built several blast furnace plants, some of the first in England to be equipped with hot blast stoves; he also put in a number of large pumping plants in the Forest of Dean. In 1866 he founded the firm of Felding & Platt, which now employs over 450 men. In 1873 he took out, with Mr. R. H. Tweddell, the first patent on a hydraulic riveting machine. This was followed by many more, and since that date he has been closely identified with the development of hydraulic machine tools. It was he who saw the need of making riveting and flanging machines of heavy power to enable boilers to be built to stand the heavy pressure then coming into use. It was this foresight which enabled his firm to equip three-fourths of the marine and locomotive shops in England and on the Continent with their hydraulic system. His most important plant in this country is that of the hydraulic tools at the Juniata shop of the Pennsylvania Railroad at Altoona. The last large piece of work he conceived and designed was the building of the gigantic gantry superstructure and riveting plant for Harlan & Wolff, of Belfast, now being used for the building of the White Star steamship Oceanic. With this plant practically every rivet in the ship will be put in by hydraulic power.

Mr. Platt always took an active part in the work of the English engineering institutions, and visited this country with the Iron and Steel Institute, when they made their memorable trip. He took an active interest in local politics, being a Liberal and follower of Gladstone. He was Mayor of Gloucester for two terms, was for 20 years a Town Councillor and Alderman, was a Justice of the Peace and also held numerous other local offices. Mr. Platt leaves a widow, five sons and a daughter. His eldest son, Mr. John Platt, is now resident in New York.

ELECTIONS AND APPOINTMENTS.

Addyston & Ohio River.—The change in officers of this company is as follows: Daniel McLaren, President, succeeding Matthew Addy; W. L. Davis, General Manager; A. H. Davis, General Freight Agent, succeeding E. A. Kebler. The general office is at Cincinnati, O.

Atlantic & Danville.—H. E. Hutchens, heretofore Assistant Superintendent, has been appointed Superintendent; the office of Assistant Superintendent has been abolished. Headquarters at Norfolk, Va.

Baltimore & Ohio.—Thomas McGill, heretofore Assistant Ticket Agent at Chicago, Ill., has been appointed Traveling Passenger Agent at St. Louis, Mo., succeeding Joseph P. Taggart, who has been transferred to Philadelphia, Pa., as City Ticket Agent. W. A. Pussen, heretofore Clerk in the General Passenger Department at Chicago, succeeds Mr. McGill. Appointments effective Jan. 1. G. W. Light has been appointed Assistant Trainmaster and Supervisor of Engines of the Second Division, Berkeley Springs & Potomac and South Branch railroads, with headquarters at Martinsburgh, W. Va., succeeding J. D. Reister, resigned.

Canadian Pacific.—F. W. Morse has been appointed Agent at Kobe, Japan, succeeding Frazer & Co.

Central of Georgia.—P. J. Milan has been appointed Master Mechanic, with headquarters at Augusta, Ga., succeeding W. H. Stulb, transferred. W. H. Craven has been appointed Trainmaster of the Second Division, succeeding J. Hall, transferred. (See this column for last week.) W. T. Nall has been appointed Commercial Agent at Montgomery, Ala., succeeding W. T. Dernforth.

Central of New Jersey.—Charles W. Kinsman has been appointed Paymaster, succeeding George F. Hess, deceased.

Charleston & Western Carolina.—E. W. Mills, heretofore Assistant Treasurer, with headquarters at Augusta, Ga., has been appointed Auditor, with headquarters at the same place, in addition to his present duties, succeeding William McLeod, resigned.

Chester & Becket.—The officers and directors of this new road are: President, James A. Rumrill, Springfield, Mass.; Treasurer and Clerk, Charles E. Stevens, Hingham, Mass. Directors: James A. Rumrill, Springfield, Mass.; Edward D. Hayden, Woburn, Mass.; Samuel Hoar, Concord, Mass.; Charles E. Stevens, Hingham, Mass.; Zenas Crane, Dalton, Mass.; Nathan A. Harwood, Chester, Mass.; William A. Harder, Jr., Frederick J. Collier, and Smith Thompson, Hudson, N. Y. (See these columns for Aug. 6 and Sept. 10, 1897.)

Chicago & Northwestern.—H. R. McCullough, heretofore Traffic Manager, has been made Third Vice-President, succeeding H. G. Burt, resigned, to accept the presidency of the Union Pacific. There will be no successor to Mr. McCullough as Traffic Manager; he will continue to manage the affairs of that department as heretofore.

Chicago, Burlington & Quincy.—J. H. McPartland, heretofore Assistant Superintendent of the Iowa lines, has been appointed Assistant Superintendent at Burlington, Ia., succeeding W. C. Cross, resigned. G. W. Faber, Roadmaster at Ottumwa, Ia., has been appointed Trainmaster, with headquarters at the same place. W. H. Double has been appointed Roadmaster at Ottumwa, succeeding Mr. Faber, promoted. Appointments effective Jan. 1. B. A. Barrows, heretofore Cashier at St. Joseph, Mo., has been appointed Paymaster on the Missouri lines. Edward C. Browne, who has been acting as Paymaster, has resumed his duties as Chief Clerk to the General Manager.

Chicago, Milwaukee & St. Paul.—W. N. Day has been appointed Division Passenger and Freight Agent at Sioux City, Ia., succeeding F. W. Boltz. C. N. Curtis, Station Agent at Sioux City, Ia., has been appointed Commercial Agent in addition to his present duties, effective Jan. 1.

Columbia Southern.—The new officers of this company are: W. S. Lythe, Auditor; E. E. Cooper, Chief Engineer; D. J. Harris, Superintendent, with offices at Waco, Tex.

Fitchburg.—Hon. J. R. Leeson has been appointed by Governor Wolcott, of Massachusetts, as one of the State Directors, succeeding David P. Kimball, resigned.

Flint & Pere Marquette.—George C. Conn has been appointed Commercial Agent for Minneapolis and St. Paul, with headquarters at Minneapolis, Minn.

Georgia & Alabama.—At the annual meeting of the stockholders, held in Savannah, Ga., Dec. 28, two new Directors, Henry A. Parr, of Baltimore, Md., and J. B. Holst, of Columbus, Ga., were added to the Board.

Grand Trunk.—D. O. Woods has been appointed to succeed J. H. Hannah as Assistant Foreign Freight Agent, with headquarters at Toronto, Ont., Jan. 1. (See this column for Dec. 17.)

Great Northern.—S. F. Forbes has been appointed Superintendent of Car and Machine Shops at St. Paul, Minn. Appointment effective Jan. 1. The duties of this position have been performed heretofore by the Master Mechanic under the direction of the Superintendent of Motive Power. Mr. Forbes was heretofore Storekeeper.

Gulf, Colorado & Santa Fe.—W. B. Scott, heretofore Trainmaster of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., has been appointed Superintendent of the Southern Division of the Gulf, Colorado & Santa Fe, with headquarters at Temple, Tex., succeeding J. W. Dickinson, resigned.

Hidalgo & Northeastern.—T. Mancera has been appointed Traffic Manager, with headquarters at City of Mexico.

Holly River.—Charles M. Warner has been elected Vice-President, succeeding C. R. Ellicott.

Illinois Central.—John F. Wallace, who resigned as Chief Engineer of the Illinois Central last July (see these columns for July 16) to become Vice-President and General Manager of the Mathieson Alkali Works at Providence, R. I., has returned to the Illinois Central as Assistant to the Second Vice-President. His office will be in Chicago, Ill. Appointment effective Jan. 1.

Intercolonial.—William Robinson has been appointed General Traveling Freight Agent, with headquarters at St. John, N. B. Abraham Quellette, heretofore Mechanical Foreman at Riviere du Loup, P. Q., has been appointed Superintendent of the Quebec and ... te. Flavie District, with headquarters at the same place.

Jamestown & Lake Erie.—The new officers of this company are: C. D. Austin, Auditor and Assistant Treasurer; J. McCanertny, Assistant Secretary; C. T. Miller, General Freight Agent; F. H. Farquharson, General Passenger Agent, with offices at Jamestown, N. Y.

Louisville, Evansville & St. Louis—M. A. Zook, heretofore Roadmaster of the Albama Great Southern, with headquarters at Birmingham, Ala., has been appointed Superintendent of Maintenance of Way, with headquarters at Princeton, Ind., succeeding T. A. Allen, resigned.

Memphis & Charleston.—H. C. Keller has been appointed Paymaster, with headquarters at Memphis, Tenn., succeeding C. P. Cooper, promoted. (See this column for last week.)

Missouri Pacific.—J. E. Rehlander, heretofore Traveling Passenger Agent, with headquarters at Memphis, Tenn., has been transferred to Chattanooga, Tenn. Walter B. Townsend has been appointed Traveling Passenger Agent, with headquarters at Memphis, Tenn.

New York Central & Hudson River—F. B. Harrington has been appointed Inspector of Signals of the Mohawk Division, succeeding Clifford Lewis, resigned. (See these columns for Dec. 17.)

Northern Pacific.—Charles Russell, heretofore Roadmaster at Missoula, Mont., has been appointed Superintendent of the Rocky Mountain Division, succeeding E. J. Parsons, transferred. (See this column for Dec. 3.)

Pennsylvania.—George B. Ogden has been appointed General Freight Agent of the Middle Division, with headquarters at Harrisburg, Pa., succeeding Thomas L. Wallace. Effective Jan 1.

Arthur E. Hale has been appointed to the newly created office of Superintendent of Telegraph, with headquarters at Philadelphia, Pa.

Pittsburgh, Bessemer & Lake Erie.—O. J. Hammon has been appointed Division Freight Agent, with headquarters at Pittsburgh, Pa. The office of General Agent at Grenville, Pa., formerly held by J. T. Blair, has been abolished.

St. Louis & San Francisco.—J. G. Doolittle has been appointed Traveling Passenger and Freight Agent, with headquarters at Denver, Col., succeeding H. B. Cole.

Seaboard Air Line.—W. R. Royster has been appointed Commercial Agent, with headquarters at Birmingham, Ala. I. K. Dye has been appointed Commercial Agent, with headquarters at Chattanooga, Tenn. Appointments effective Jan. 1.

South Carolina & Georgia.—James Meehan has been appointed Superintendent of Motive Power and Machinery with headquarters at Charleston, S. C., succeeding J. H. Green, resigned, Jan. 1. T. J. Lockwood has been appointed Train Master, with headquarters at Charleston, S. C., succeeding F. P. Brown.

Toledo, St. Louis & Kansas City.—Martin C. Casts, heretofore Freight Solicitor of the Chicago, Rock Island & Pacific at St. Joseph, Mo., has been appointed Contracting Agent of the Toledo, St. Louis & Kansas City, with headquarters at Kansas City. Appointment effective Jan 1.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Alaska Railroads.—A bill has been introduced in Congress by Representative Ellis for aid in building a line for the transportation of persons and property from Dyea, Alaska, to the head of Lake Bennett. This is probably the line of the Chilkoot Railroad & Transportation Co., of which a full account was given in this column for Oct. 15 and Nov. 12.

Senator Falkner has introduced a bill to incorporate the Cook's Inlet, Tanana & Yukon Railroad Co., and to grant it a right of way over public lands in the District of Alaska. The capital stock is not to exceed $60,000,000. The incorporators are Christian Devils and Robert Rumsey, of Baltimore, Md.; Geo. R. Blanchard, of New York; Watson C. Squires, of Seattle, Wash., and Geo. R. Tingle, of Snug Harbor, Alaska.

Senator Perkins has introduced a bill authorizing the Alaska Railway & Transportation Co. to construct, operate and maintain a railroad, tramway and telegraph line in the District of Alaska, with a grant of right of way through government lands in that district.

Senator McBride has introduced a bill granting right of way through public lands in the District of Alaska to the Skaguay & Lake Bennett Tramway Co.

Altoona & Beach Creek.—Surveys have been begun for the extension from Phillipsburg, Pa., to Johns town, about 60 miles. This road has recently been consolidated with the Pittsburgh, Johnstown, Ebensburg & Eastern. (See these columns for Dec. 17.)

Arizona & Southeastern.—According to reports this company is relaying its road between Bisbee, Ariz., and Fairbank, with 75-lb. rails. This is understood to be preparatory to an extension from Bisbee, south to Nacasari, Mexico. The present road extends from Benson, Ariz., to Bisbee, 55.3 miles. It is owned by the Copper Queen Mining Co., of Bisbee.

Baltimore & Ohio.—It is reported that work will begin at once on the Salisbury Branch to the Manansses Beachy coal tract, three miles southwest of Salisbury, Pa.

California Southern.—It is reported that rails have been laid on the entire line from Kramer, Cal., a point on the Atlantic & Pacific, north 29½ miles, to Johannesburg. A. A. Dougherty, Los Angeles, Cal., is President. (See this column for Dec. 24.)

Chicago & Northwestern.—A letter from this company states that it is the intention to complete double track into Iowa as far as Tama the coming season, but that extension beyond that point has not yet been determined.

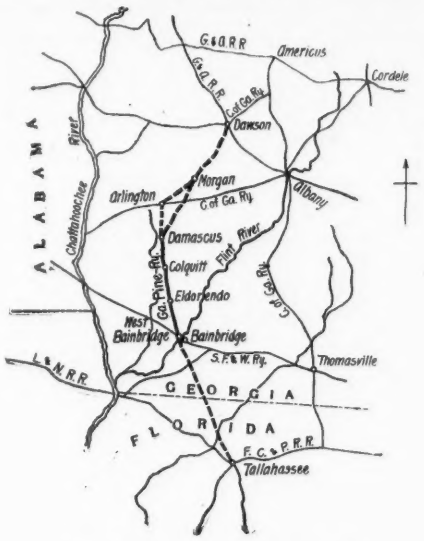
Columbus Northwestern.—It is officially stated that track laying began on this road Dec. 28, and the company expects by Feb. 1 to have 22 miles laid from St. Johns, O., on the Ohio Southern, north to Bellefontaine. Equipment will be furnished by the Detroit & Lima Northern. J. T. Adams, of Bellefontaine, is General Manager. (See this column for Dec. 3.)

Cripple Creek Short Line.—It is reported that surveys have been begun on this line projected to run from Colorado Springs, Col., west through Bear Creek Canyon, Seven Lakes and Dead Lake, to Cripple Creek, about 40 miles. (See this column for Dec. 3.) Among those interested are John I. Franklin and Harry B. Stone, of Colorado Springs. The company's headquarters are in the DeGraff Building, Colorado Springs.

Elgin, Joliet & Southern.—It is reported that this company will begin in early spring to build an extension from Dyer, Ind., southeast, 12 miles, to Crown Point.

Erie & Central New York.—It is officially stated that the first 12 miles of this line from Cortland, N. Y., southeast to Cincinnatus, has been completed, and that trains began running Dec. 27. J. W. Coffin has the contract for the section from Solon to Cincinnatus, 10 miles. Grading is nearly completed, and five miles of track has been laid on this contract. W. D. Tisdale, of Cortland, N. Y., is President. (See this column for Dec. 10.)

Georgia Pine.—It is officially stated that 29 miles of this road from West Bainbridge, Ga., north to Damascus, has been completed. For the extension from Damascus, north to Dawson, the route has not yet been settled. The company is preparing to run one line by



Line of the Georgia Pine Railroad.

way of Arlington and another direct from Damascus to Dawson. It is also proposed to extend the road south to Tallahassee, Fla. R. B. Coleman, of Bainbridge, Ga., is General Manager and Arthur Pew, of Colquit, Ga., Chief Engineer. (See this column for Dec. 3.)

Gila Valley, Globe & Northern.—A bill has been introduced into both Houses at Washington, granting right of way through the San Carlos Indian reservation in Arizona. The bill was introduced into the House by Mr. Smith, of Arizona, and into the Senate by Mr. Cullam. The Committee on Indian Affairs has reported a bill with an amendment. This company is building a line from Geronimo, Ariz., northwest 60 miles to Globe. William Garland, 313 Stimson Building, Los Angeles, Cal., is President. (See this column for Dec. 10.)

Kansas City, Pittsburgh & Gulf.—It is officially stated that surveys are now being made for an extension from Redland, I. T., northeast to Fort Smith, Ark. (See this column for Dec. 3.) The company has begun building a branch line from a point 12 miles south of Redland, northeast 16.5 miles to Fort Smith. The maximum grade is one per cent., the maximum curvature five degrees. There will be one steel bridge over Poteau River, 200 ft. long. Bernard Corrigan, of Kansas City, Mo., holds the contract. The extension from Quincy, Ill., northeast, referred to in this column for Dec. 17, has not yet been determined upon.

Miami River & Belt.—This company has been incorporated in Ohio with a capital stock of $10,000, to build, lease and operate a railroad belt line running through the counties of Auglaize, Logan, Shelby and Miami, from the village of St. Mary's, through Shelby, Lake View, and thence to St. Mary's, with an extension from Sidney, south to Piqua. The incorporators are: Charles Timens, I. H. Therdick, H. T. Mathers, Frank Hunter, G. L. Hunter and A. T. Wells.

Missouri & Iowa Southern.— Work was begun at East Sedalia, Mo., Dec. 30, to build this road, which was incorporated Oct. 19 to build a line from Sedalia north 50 miles to Miami, a point on the Wabash. A. L. Strong, of Sedalia, Mo., is Vice-President and General Manager.

Muscogee Coal & Railway Co.—A bill has been introduced into the United States Senate by Senator Baker authorizing this company to build and operate a railroad through the Indian and Oklahoma territories.

San Francisco & San Joaquin Valley.—This company is reported to have placed a contract with John F. Merrill, of San Francisco, for 8,000 tons of rails to be used in building the extension from Stockton, Cal., west to San Francisco. (See this column for Dec. 10.)

Santa Rita.—This company was incorporated in New Mexico, Dec. 27, with a capital stock of $50,000, to build an extension of the Atchison, Topeka & Santa Fe, from San Jose, near Silver City, N. Mex., into the Santa Rita gold-copper district. The Directors are: E. P. Ripley, of Chicago, a Director in the Atchison, Topeka & Santa Fe; R. K. Palen, J. H. Vaughan, R. C. Gortner, all of Santa Fe; H. L. Waldo and R. E. Twitchell, of Las Vegas, N. Mex. It is stated that the new road is to be built at once.

Smith's Falls, Rideau & Southern.—A bill is before the Ontario Parliament to incorporate this company with a capital stock of $300,000. The road as projected is to run from Smith's Falls, south, through Portland, Rideau Lake, to North Augusta.

Spokane Falls & Northern.—A bill has been introduced into the United States Senate by Senator Wilson granting a right of way to this company through the Colville Indian Reservation, in Washington. The Committee on Indian Affairs recommends the passage of the bill, which provides also for a branch line, commencing at a point in Stevens County, crossing the Columbia River, and running northwest by the most feasible route through the northern part of this reservation, to connect on the International boundary line with a road to be built in British Columbia.

Tennessee Central.—Jere Baxter, of Nashville, Tenn., President of this company, has made the first payment on the $125,000 purchase price of that road. It is stated that $1,250,000 of the total $1,500,000 capital stock has been subscribed, that rails have been contracted for with the Carnegie Steel Co. for the extension into Knoxville, Tenn., and that work will begin at an early date.

Toledo & Northwestern.—It is officially stated that two-thirds of the grade has been completed on this line from Albion, Mich., north 24 miles through Duck Lake and Duttonville, to Charlotte, a point on the Chicago & Grand Trunk. The company expects to lay track before spring. Sam. A. Williams, of Albion, Mich., is General Traffic Manager. (See this column for Nov. 26.)

Electric Railroad Construction.

Allentown, Pa.—The Allentown & Emaus Street Railway Co., of this city, was incorporated Dec. 28 with a capital stock of $50,000. It is proposed to build an electric railroad from Aineyville to Bethlehem, Mountainville and Demaus, with a branch line to Allentown. T. J. Crilley, Allentown, President.

Beaumont, Tex.—The county commissioners have granted the Sabine Terminal Railway and the Union Depot Company right of way to build a railroad on First street.

Fitchburg, Mass.—It is reported that the Fitchburg & Leominster Street Railway Co. has been granted permission to extend its line for several miles.

Hannibal, Mo.—The Hannibal, Palmyra & New London Electric Railroad Co., it is reported, will soon build a line to New London by way of Oakland. D. Thompson, President and General Manager.

Kansas City, Kan.—The Kansas City, Lawrence & Topeka Electric Railroad Co. has been granted a charter with a capital stock of $3,000,000.

Kittaning, Pa.—The Kittaning & Ford City Street Railway Co. has been incorporated, with a capital stock of $50,000, to build an electric railroad from Nealeton to Ford City by way of Kittaning. Frank A. Moesta, Kittaning, President.

Lansing, Mich.—The Lansing, Dexter & Ann Arbor Electric Railway Co. has been organized to build an electric railroad from Lansing to portions of Ingham and Livingston counties. Capital stock, $250 000. The officers given are C. A. Mapes, of Livingston, President, and Thomas Burkett, of Dexter, Treasurer.

New York.—The Hudson River & Long Island Sound Railway Co., with its principal office in New York City, was incorporated Dec. 29 with a capital of $100,000, to build an electric railroad in Westchester County, about 10 miles in length, from the New York Central station in Yonkers to the village of Pelham Manor, near the New York City line. The Directors are Charles C. Bassett, of Washington; Henry A. Welch, of Detroit; James F. Secor, Jr., of Pelham Manor; D. B. Halstead, Paul Gorman and John H. Seed, of Brooklyn; Seward Baker and Walter R. Quick, of New York City and William L. Stout, of Elizabeth, N. J.

Rockford, Ill.—Concerning the Rock River Electric Railway Co. (*Railroad Gazette* Nov. 25) we are officially informed that contracts will be let immediately, and it is expected to commence work on the section from Oregon to Rockford (25 miles) early in the spring. The other portion of the line will not be built until later. The officers are E. M. Hopkins, President; J. S. Ticknor Secretary; Charles Schneider, Treasurer. Among the Directors are D. D. Aiken, Flint, Mich., J. Farson and E. M. Hopkins, Chicago. Chicago office of the company is at 33 Monroe street.

Sedalia, Mo.—It is reported that the capital has been fully subscribed for the proposed Sedalia & McAllister Springs Electric Railway Co., and that the company has applied for a franchise from the City Council of Sedalia. The distance between Sedalia and McAllister Springs is 25 miles.

Springfield, Mass.—The Springfield Street Railway Co., is expected at its annual meeting, to be held Jan. 12, to decide to again increase its capital stock. This company has in view plans for extending its tracks from Tatham to Westfield, and for a line to East Long Meadow. The company also plans an addition of 1,600 H. P. to its generating plant.

Syracuse, N. Y.—A contract for grading the Onondaga Lake Railroad has been let to Gleason & Kiley, of Syracuse.

Wilmington, O.—The Baton Spring Valley & Wilmington Transit Co. has been incorporated with a capital stock of $50,000.

GENERAL RAILROAD NEWS.

Railroad Earnings.

[Showing the gross and net earnings for the periods ending at the dates named.]

October 31:		1897.	1896.	Inc. or Dec.	
Choctaw, Oklahoma & Gulf.					
12 months	Gross	$1,231,344	$1,079,057	I.	$152,287
12 "	Net	393,304	228,607	I.	164,697
Grand Rapids & Indiana.					
1 month	Gross	$241,384	$191,024	I.	$50,324
1 "	Net	64,364	21,105	I.	43,259
10 months	Gross	2,094,562	2,104,593	D.	10,031
10 "	Net	526,077	374,217	I.	151,860
Kansas City, Pittsburgh & Gulf.					
1 month	Gross	$257.875	$90,791	I.	$167,084
1 "	Net	88,414	22,105	I.	66.309
Savannah, Florida & Western.					
1 month	Gross	$299,922	$320,441	D.	$20,519
1 "	Net	79,867	215.216	D.	35,349
4 months	Gross	1,080,066	1,057,108	I.	22,958
4 "	Net	279,025	246,979	I.	32,046
November 30:					
Buffalo, Rochester & Pittsburgh.					
1 month	Gross	$322.100	$301,898	I.	$20,202
1 "	Net	125,233	108,065	I.	9,168
5 months	Gross	1,613,043	1,539.649	I.	73,394
5 "	Net	596,139	526.921	I.	69,218
Canadian Pacific.					
1 month	Gross	$2,540.451	$1,964,634	I.	$575,787
1 "	Net	1,189.733	862,148	I.	327,585
11 months	Gross	22,736,791	18,755,663	I.	3,971,128
11 "	Net	9,250,321	7,183,150	I.	2,067,171
Chicago, Milwaukee St. Paul.					
1 month	Gross	$3,328,446	$2,738,520	I.	$589,926
1 "	Net	1,470,416	1,255,629	I.	214,787
5 months	Gross	15,613,198	14,167,405	I.	1,445,793
5 "	Net	6,278,571	5,543 868	I.	734,703
Cincinnati, New Orleans & Texas Pacific.					
1 month	Gross	$335,482	$280,248	I.	$55,234
1 "	Net	122,553	101 500	I.	21,053
5 months	Gross	1,599,333	1,417,187	I.	8? 146
5 "	Net	535,897	388,369	I.	147,528
Cleveland, Cincinnati, Chicago & St. Louis.					
1 month	Gross	$1,209,478	$1,019,841	I.	$189,637
1 "	Net	266,619	249,561	I.	17.058
5 months	Gross	6,095,822	5,484,973	I.	610,849
5 "	Net	1,383,002	1,334,529	I.	48,473
Denver & Rio Grande.					
1 month	Gross	$808,165	$609,750	I.	$198,415
1 "	Net	313,576	248 403	I.	65 173
5 months	Gross	3,714.549	3,201,894	I.	512,655
5 "	Net	1,513,320	1,320,591	I.	192,729
Erie.					
1 month	Gross	$2,956,020	$2,874,327	I.	$81,693
1 "	Net	819.192	797 862	I.	21,330
11 months	Gross	32,879,718	31,361,747	I.	1,518,971
11 "	Net	8,377,170	8,258.199	I.	118,971
Louisville & Nashville.					
1 month	Gross	$1,841.650	$1,749.812	I.	$99,838
1 "	Net	677 860	611,088	D.	3,228
5 months	Gross	9,148.537	8,737,945	I.	410,592
5 "	Net	3,103,962	2,959,296	I.	244,666
Mexican Central.*					
1 month	Gross	$1,128,734	$887,627	I.	$241,307
1 "	Net	398,287	240,606	I.	157 681
11 months	Gross	11,630,709	9,192,109	I.	2,428,609
11 "	Net	3,540,804	3,151,257	I.	389,547

* Mexican currency.

Minneapolis, St Paul & Sault Ste Marie.					
1 month	Gross	$165,746	$297,593	I.	$168,154
1 "	Net	256.108	113,937	I.	142,171
11 months	Gross	3,594,548	3,392 998	I.	201.550
11 "	Net	2,566 118	1,397,268	I.	168,850
New York, Ontario & Western.					
1 month	Gross	$348,747	$337,790	I.	$10.457
1 "	Net	111,315	110,612	I.	703
5 months	Gross	1,869,839	1,847,990	I.	21,849
5 "	Net	614,299	623,976	D.	9,677
Oregon Railroad & Navigation.					
1 month	Gross	$662,062	$478,867	I.	$183,195
1 "	Net	311.330	235,789	I.	75,541
5 months	Gross	3,086,542	2.311,401	I.	775,141
5 "	Net	1,558,933	1,091,747	I.	467,186
Pacific Mail.					
1 month	Gross	$338,080	$324.051	I.	$14,029
1 "	Net	59,332	54,833	I.	4,499
7 months	Gross	2,313,065	2,242.012	I.	71,053
7 "	Net	450,651	362,744	I.	88,907
Pennsylvania.					
1 month	Gross	$5,819,924	$5,246 424	I.	$573.500
1 "	Net	1.960.656	1,796,256	I.	164,400
11 months	Gross	58,605,265	56.904,265	I.	1,701,000
11 "	Net	18,867,566	16,565,468	I.	2,302,100
Pennsylvania Company.					
1 month	Gross	.....	.....	I.	$918,900
1 "	Net	.....	.....	I.	594,000
11 months	Gross	.....	.....	I.	1,135,500
11 "	Net	.....	.....	I.	1,702,800
Southern Pacific.					
1 month	Gross	$4,896,775	$4,503,802	I.	$392,973
1 "	Net	2,112.739	7,162,311	I.	350,428
5 months	Gross	23,658,077	22,128,011	I.	1,530.066
5 "	Net	10,099,113	8,852,397	I.	1,246,716
Wabash.					
1 month	Gross	$1,061,231	$905,840	I.	$155,391
1 "	Net	268,894	228,651	I.	40,243
5 months	Gross	4.757,565	5,168,683	D.	411,118
5 "	Net	1,933,338	1,609,060	I.	324,278
Western New York & Pennsylvania.					
1 month	Gross	$317,892	$251,375	I.	$66,517
1 "	Net	121,010	88,422	I.	32,588
December 31:					
Chicago, Rock Island & Pacific.					
1 month	Gross	$1,518.110	$1,237,135	I.	$280,975
12 months	Gross	16,824,897	15,421,698	I.	1,403,199
Denver & Rio Grande.					
6 months	Gross	$4,184,833	$3,573,344	I.	$611,539
Mobile & Ohio.					
1 month	Gross	$400,600	$367.132	I.	$23,468
12 months	Gross	4,008,582	3,716,757	I.	292,825
Texas & Pacific.					
1 month	Gross	$886.753	$817,415	I.	$69,338
5 months	Gross	7,499,703	6,825,144	I.	674,559

Atlantic & Danville.—The earnings for the year ended June 30, according to the annual report, were as follows:

Year:	1897.	1896.	Dec.
Gross earn	$543,770	$569,018	$25,248
Oper. expen	404,857	429.124	24,267
Net earn	$138,913	$139,894	$981
Fixed charges	61,900	61,900	.....
Balance	$77,013	$77,994	$981

Central of South Carolina.—The earnings of this line of the Atlantic Coast Line for the year ended June 30, according to the annual report, were as follows:

Year:	1897.	1896.	Inc. or Dec.	
Gross earn	$94,833	$93.601	D.	$3.748
Oper. expen	55,270	59,300	D.	4,030
Net earn	$39,563	$39,301	I.	$262

Central Pacific.—On Jan. 1 there became due $10,614,000 of second mortgage bonds guaranteed by the government. The net indebtedness to the government on that date was $46,752,087.

Charleston & Western Carolina.—Gen. Samuel Thomas and Thomas F. Ryan, of New York, have sold out the entire capital stock of the Charleston & Western Carolina to the Atlantic Coast Line. This road extends from Port Royal, S. C., to Augusta, Ga., 112 miles, and from Augusta to Spartanburg, S. C., 133.1 miles, with branches from McCormick to Anderson, S. C., 57.75 miles, and from Laurens to Greenville, S. C., 36.3 miles, making a total of 339.15 miles.

Chesapeake & Ohio.—This company has sold $1,500,000 of the general mortgage 4½ per cent. bonds held in its treasury.

Chicago & Northwestern.—Holders of five and six per cent. sinking funds bonds of 1879 are notified that

the sum of $140,166 has been set aside to purchase as many of these bonds as it will pay for at the rate of 105 per cent. and accrued interest and that the bonds will be drawn by lot Jan. 31, interest ceasing after that date.

Chicago, Milwaukee & St. Paul.—Holders of Income Sinking Fund convertible five per cent. bonds are notified that $47,000 of these have been elected by lot to be paid in accordance with the terms of the bonds, at the New York office, the rate being 103 per cent., with accrued interest. Interest will cease after Feb. 3.

Cleveland & Pittsburgh.—Holders of construction and equipment bonds are notified that 20 of these bonds have been drawn for payment at the office of the Farmers' Loan & Trust Co., New York, on or before July 1, at par with accrued interest, and that interest will cease after that date.

Cleveland, Cincinnati, Chicago & St. Louis.—Holders of Cleveland, Indianapolis & St. Louis Consolidated 6 per cent. mortgage bonds are notified that seven of these bonds have been drawn for payment from the sinking fund account of Nov. 1, to be paid at 105 per cent. with accrued interest, in accordance with the provisions of the mortgage, and that interest will cease after May 1.

Delaware River & Lancaster.—A. H. Winterstein Special Master, has sold to Samuel Thomas, all the property of this road completed and projected. The road is projected to extend from Point Pleasant, Pa., east, through the counties of Bucks, Montgomery, Chester and Berks, to Lancaster in Lancaster County, a distance of 80 miles. Of this, 12 miles from French Creek Junction to St. Peters has been completed. (See this column for Sept. 17.)

East Broad Top.—It is reported that the Berwin Coal Mining Co. of Huntington, Pa., has purchased the property of this company, including the railroad from Mount Union, on the Pennsylvania main line to Woodvale, 31.1 miles, and its coal mines, furnaces and timber lands. It is said that the road is to be made broad gage.

Illinois Central.—Holders of first mortgage and terminal 20-year gold bonds of the St. Louis, Alton & Terre Haute are notified that, in accordance with the provisions of the mortgage, the company wishes to redeem them on June 1, at its agency in New York, the rate being 105 per cent. with interest. These bonds were issued June 1, 1894 (2,500,000 outstanding).

Mobile & Ohio.—A limited number of five per cent. mortgage bonds of the Montgomery Division ($4,000,000 total issue) are offered at 94½, with accrued interest. The proceeds are to be used for the extension to Montgomery, Ala., now under construction.

Morristown & Cumberland Gap.—This road was offered for sale at auction for the third time by Special Master H. M. Sherwood, at Morristown, Tenn., on Dec. 27. There were no bidders and it is said that the upset price of $85,000 will be scaled down. (See this column for Dec. 10.)

New York Central & Hudson River.—It is announced by J. P. Morgan & Co., of New York, that $20,000,000 of the 3½ per cent. bonds of 1997 are ready to be exchanged for old securities at 103 per cent., with accrued interest to date, as follows: First mortgage 7 per cent. and first mortgage 6 per cent. Sterling bonds due Jan. 1, 1903; extended 4 per cent. debt certificates, due May 1, 1905; 5 per cent. debentures due Sept. 1, 1904, and 4 per cent. debentures due June 1, 1905.

Ohio River & Lake Erie.—A mortgage for $700,000 was recorded at Steubenville, O., Dec. 30, to secure an issue of bonds to repay $350,000, the purchase price of the road, and to provide a fund for its extension and equipments. This company is the successor of the Lake Erie, Alliance & Southern, and the line extends from Alliance, O., to Bergholz, 36 miles.

Omaha, Kansas City & Eastern.—A mortgage for $14,000,000 was recorded at Council Bluffs, Ia., Dec. 28, the proceeds of which, according to the mortgage, are being used to acquire the Quincy, Omaha & St Louis, and to build the Kansas City & Northern Connecting and a line in an easterly direction to some competing point in Illinois. Most of these plans have already been carried into effect.

Oregon Railway & Navigation Co.—Holders of first mortgage six per cent. bonds are notified that 137 of these have been drawn by lot and are payable at par at the office of the Farmers Loan & Trust Co., New York.

Pittsburgh, Akron & Western.—The stockholders of this company, recently reorganized as the Northern Ohio, have been called upon for an assessment to meet the outstanding debts of the old company, of which the principal claim is from the Carnegie Steel Co. for $87,640. The Central Trust Co., of New York, which owns most of the stock, has an assessment of $100,350.

Western New York & Pennsylvania.—The earnings for the year ended June 30, according to the annual report, were as follows:

Year:	1897.	1896.	Dec.
Gross earn.	$2,944,774	$3,186,031	$231,257
Oper. expen	2.042.916	2,233,911	190,965
Net earn.	$911,858	$952,120	$40,292

Wilmington & Weldon.—The earnings of this line of the Atlantic Coast Line for the year ended June 30, according to the annual report, were as follows:

Year:	1897.	1896.	Inc.
Gross earn.	$1,854,006	$1,803,196	$50,810
Oper. expen	1,088,841	1,067,207	21,634
Net earn	$765,165	$735,089	$29.176

Wilmington, Columbia & Augusta.—The earnings of this line of the Atlantic Coast Line for the year ended June 30, according to the annual report, were as follows:

Year:	1897.	1896.	Inc.
Gross earn.	$697.258	$637,241	$60,017
Oper. expen	503,304	451,406	51,898
	$193,954	$185,835	$8,119

Electric Railroad News.

Bennington, Vt.—The Bennington & Hoosac Valley Electric Railroad, it is reported, has been mortgaged to the International Trust Co., of Boston, for $250,000. The mortgage deed covers the Hoosac Falls road which has been in operation for several years and the road which is in process of building between Bennington and North Bennington. The total length of the road is 16½ miles. It is expected that the Bennington end of the line will be run within a few months.

Boston, Mass.—Considerable changes have taken place in the executive department of the West End Street Railway Co. since the road has been leased to the Boston Elevated Railroad Co. Gen. William A. Bancroft succeeds Mr. Little as the chief executive of the West End, his position being that of Vice-President and General Manager of the Boston Elevated Railroad Co. Mr. Samuel Little however, remains as President of the West End Company, the position being an inactive one, with a salary of $3,000 a year. Mr. Parker Dexter has been elected Treasurer of the West End Street Railway Co.

The Boston Rapid Transit Commissioners are now pushing to completion plans for the proposed East Boston tunnel. The legislative act calls for a tunnel or tunnels of sufficient size for two railroad tracks with approaches. The tunnel will extend from Hanover street to Maverick Square, East Boston. When completed it will be leased to the Boston Elevated Railroad Co. for 25 years from June 10, 1897, at ⅝ per cent. of gross receipts, bringing the lease to maturity at the same time as that of the subway.

The projectors of the Neponset & Forest Hills Electric Street Railroad Co. are feeling anxious and complaining of the delay on the part of the railroad committee and the Board of Aldermen in reporting their petition for a location which was filed last April, and efforts are being made to serve the petition at an early date.

The Ferry street car house of the West End Street Railway Co. was destroyed by fire Dec. 24, together with 90 cars. The loss is estimated at $150,000.

Brooklyn, N. Y.—The gross earnings of the lines of the Brooklyn Rapid Transit Co. are reported as follows:

December:	1897.	1896.
Pass. earn. B. H. & B. Q. Co. & S.	$429,840	$413 291
Other earnings from operation.	16,960	19,460
Gross earn.	$446,800	$432,751
6 months ending Dec. 31, 1897:		
Pass. earn. B. H. & B. Q. Co & S.	$2,701,378	$2,623,726
Other earnings from operation	104,092	113,552
Gross earn.	$2,805,470	$2,737,278

The United Railway Co. has been incorporated with a capital of $300,000. The Directors of the company are: Henry C. Barrow, John M. Ward, Robert B. Smith, Henry Wyse and Walter F. Downs, of Brooklyn; Henry C Evans, J. Clarence Harvey, C. M. Bates and F. W. Bruckel, of New York City.

Chicago.—The Chicago Electric Traction Co. has been incorporated with a capital stock of $2,000,000 with an extensive charter. It is proposed to build and operate an electric railroad from a point near Sixty-third street between the west line of State street and the east line of Stony Island avenue, in a southerly and westerly direction through Auburn Park, Washington Heights, Morgan Park and Blue Island, to the boundary line between the states of Illinois and Indiana; also extensions to Pullman, Kensington, West Pullman, Riverdale and Harvey. The incorporators and first Board of Directors are: Charles R. Holden, Carl Meyer, William L. Tibbs, Thomas A. Moran, Jr., Alfred S. Austrian, and E. R. Gilbert, all of Chicago; Samuel R. Shipley, of Philadelphia; Isaac L. Rice, New York City; Henry Lewis, Philadelphia; Gustave J. Wetzler and Julius S. Bache, of New York City. The company will issue $1,500,000 of bonds immediately.

It is reported that Charles T. Yerkes and the interest which he represents will build a street railroad transfer line connecting nearly all of the downtown railroad stations of Chicago.

College Point (L. I.), N. Y.—The New York & Queens County Railroad Co. has been granted a franchise to build an extension of its line in this village.

Hoboken, N. J.—On Jan. 4 the Hoboken Railroad, Warehouse & Steamship Co. formally opened its new line which is designed for freight service between the docks at Hoboken and the Erie Railroad at Weehawken. The road follows the shore from Fifth to Eleventh street, in Hoboken, where it continues along Hudson street to the Erie tracks at Weehawken. The electric locomotive built by the General Electric Co., which is to haul the freight cars, was given a thorough test which proved in all points very satisfactory. A detailed description will be given in our next issue,

Indianapolis, Ind.—Mr. Kennedy Crossan has resigned the presidency of the Citizens' Street Railroad Co.

New York.—Since the last meetings of the Directors of the Metropolitan Street Railway Co., and the Third Avenue Railroad Co., and various companies connected with these two systems, the Presidents of these companies have signed agreements, which, it is understood, will discontinue all existing litigation and other sources of difficulty between the two roads. The companies agree to go together before the Municipal Assembly and ask for the Kingsbridge franchise on such terms as shall be approved by the Board of Estimate and Apportionment. The two companies will together apply for the Boulevard from 125th street to 169th street. The Metropolitan Company will alone apply for 145th street and the Third Avenue Company alone will apply for the Kingsbridge road, extending from 162d street to Yonkers along the Kingsbridge road and Riverdale avenue. The intention of both companies is to install the conduit electrical system on all their lines. The agreements do not extend to the Amsterdam avenue route, because the Metropolitan Co. is not the owner, but only the lessee of the Ninth Avenue Railroad, and the stockholders of that company refuse, it is understood, to enter into an agreement with the Third Avenue Co.

Philadelphia.—The annual meeting of the stockholders of the Philadelphia & Beech Haven Railroad and of the Burlington & Mt. Holly Traction Co. was held in Camden a few days ago, and both corporations re-elected the same directors and officers.

TRAFFIC.

Traffic Notes.

The United States Grand Jury at Jacksonville, Fla., has returned indictments against traffic officers of the Florida, Central & Peninsula and of the Plant System for alleged violations of Sections 2 and 6 of the Interstate Commerce Law.

The railroads carrying bituminous coal to the Atlantic seaboard, the Chesapeake & Ohio, the Norfolk & Western, the Pennsylvania, the Baltimore & Ohio and the Philadelphia & Reading, have agreed to an advance of 10 cents a ton in freight rates to Philadelphia and 15 cents to New York Harbor.

Commencing Jan. 17 from Chicago and Jan. 23 from Los Angeles, the Atchison, Topeka & Santa Fe will run its California Limited train three times a weak each way, instead of twice a week as at present. Officers of the road report a very heavy California travel, rendering this increase in service necessary.

The number of cars of grain received at Chicago in the calender year 1897 was 329,618, an increase of 37,191 over the number received in 1896. Practically all of the increase was made since July 1. Since Aug. 1 the freight business of the lines west of Chicago has been heavy in all departments and all freight cars and freight engines were in use.

It is stated that the number of bicycles checked during the year 1897, on the passenger trains of the Pennsylvania lines east of Pittsburgh and Erie was 400,000. The number sent out of the Grand Central Station, New York City, over the New York Central during the same time was 26,542 and the number received, including those coming over the New Haven road, was 52,771.

The Interstate Commerce Commission in an opinion prepared by Chairman Morrison has dismissed without prejudice the case of Edwin E. Montell, who asked the Commission to fix a rate on coal from Cumberland, Md. to North Garden, Va. The decision says that as "recently interpreted by the courts the Interstate Commerce act makes no provision under which the defendants or other carriers can be ordered or required to establish or maintain any rate of charge to or from any place other than such rate of charge as any such carrier may fix or establish for itself." The term of Commissioner Morrison has expired and this decision appears to be his parting shot at the Supreme Court.

Buffalo Rail Grain Shipments.

The eastward shipments of grain by rail from Buffalo elevators during the year just closed amounted to 164,067,235 bushels, as against 120,984,620 bushels in 1896 and 94,287,770 bushels in 1895. As heretofore reported, the canal boats delivered at New York, mostly from Buffalo, during the five months ending with November, 15,355,000 bushels of wheat, corn and oats.

Chicago Elevated Railroad Traffic.

The South Side Elevated Railroad of Chicago on Dec. 24 carried 72,348 passengers, the largest number ever carried over the road on a single day. For the holiday week the number carried was 437,738, the best previous record being 407,231, at the time of the horse show, in November. Since the trains began running around the loop (in October), the number of passengers carried by the South Side daily has averaged over 350,000. The Metropolitan Elevated also did a heavy business. The number of passengers is not officially reported, but it was estimated at 73,400 daily, for Christmas week.

New York State Canal Traffic.

The New York State Department of Public Works reports the total tonnage on the canals of the state during the last season as 3,617,804 tons, as compared with 3,714,894 tons for the season of 1896, a falling off of 97,090 tons. Of board and scantling, 643,494 tons were carried; of timber, 32,868; wood, 57,777; wood pulp, 153,298; flour, 3,206; wheat, 180,035 (6,001,167 bu.); rye, 66,387; corn, 312,776; barley, 100,337; oats, 50,345; pig iron, 67,347; salt, 64,694; sugar, 41,421; anthracite coal, 520,784; bituminous coal, 126,022, and iron ore, 76,311. There was a decrease from 1896 of 346,882 tons in the products of the farms, an increase of 43,009 in the products of the forest, and an increase of 220,000 in miscellaneous articles. In 1896 there were 228,737 more tons of wheat carried on the canals than in 1897, but there were 212,549 tons more of corn carried in '97 than in '96.

The Michigan Mileage Ticket.

The new Northern Mileage Ticket Bureau, made up of the Michigan roads that seceded from the Central Passenger Interchangeable Mileage Bureau, will put its ticket on the market Feb 1.

It is said that the new ticket to be used in Michigan is precisely like that of the Central Passenger Association, except that the coupons will be accepted on the trains. The price is $30, with a rebate of $10. One of the objections to the Central ticket in Michigan was the rebate feature, the demand for a flat rate of $20 being based on the Michigan law of 1891, requiring all railroads in that state to sell family tickets at $20; and the State Railroad Commissioner, Mr. Wesselius, has made a report upon the matter to the Governor, recommending that the Attorney General begin proceedings in the courts to annul the charters of the offending railroads.

Chicago Traffic Matters.

CHICAGO, Jan. 5, 1898.

Western roads have failed to reach an agreement regarding the curtailing of livestock transportation during the coming year, and the shippers at the various stock yards in the West will continue to hold the whip hand on that disturbing question. Scalping of such passes and making a wholesale business of it, so that every stock train in the West is doing a second-class passenger business, led to a move to cut off stock passes entirely, but the roads could not agree, so the evil will continue.

The anti-scalping law now before Congress is creating considerable interest in Chicago, and a deputation of Chicago merchants will go to Washington this week to advocate the passage of the bill. Chairman Caldwell, of the Western Passenger Association, will also appear before the Senate Committee for the Western roads.

As an outcome of the recent negotiations between the Western roads and the Trans-Atlantic steamship lines the roads have decided that the representatives of the steamships are entitled to annual passes.

The volume of Westbound freight traffic is now very large, something unusual at this season of the year. No cars are being sent West empty.

The new Eastbound trans-continental tariff goes into effect on the 10th. It makes a general advance of all rates that were below 75 cents, placing most of them at that figure.

Eastbound shipments from Chicago and Chicago junctions to points at and beyond the western termini of the trunk lines for the week ending Dec. 30 amounted to 105,937 tons, as compared with 99,377 tons the preceding week. This statement includes 69,099 tons of grain, 17,474 tons of flour and 19,364 tons of provisions, but not livestock. The following is the statement in detail for the two weeks:

Roads.	Week Ending Dec. 30.		Week Ending Dec. 23.	
	Tons.	p. c.	Tons.	p. c.
Baltimore & Ohio	6,484	6.1	7,777	7.8
C., C., C. & St. Louis	4 608	4.4	7,557	7 6
Erie	8,361	7.9	7,900	8.0
Grand Trunk	8,889	8.4	3,755	3 8
L. S. & M. S.	16,415	15.5	12,361	12.4
Michigan Central	9,472	8.9	9,615	9.7
N. Y., Chi. & St. L.	8,351	7.9	8,960	9.0
Pitts., Cin., Chi. & St. Louis.	14.109	13 3	12,254	12.3
Pitts., Ft. Wayne & Chicago	20.731	19.6	20,368	20.5
Wabash	8,517	8.0	8,830	8.9
Totals	105,937	100.0	99,377	100.0